JULY 24, 1961

American Machinist / Metalworking Manufacturing

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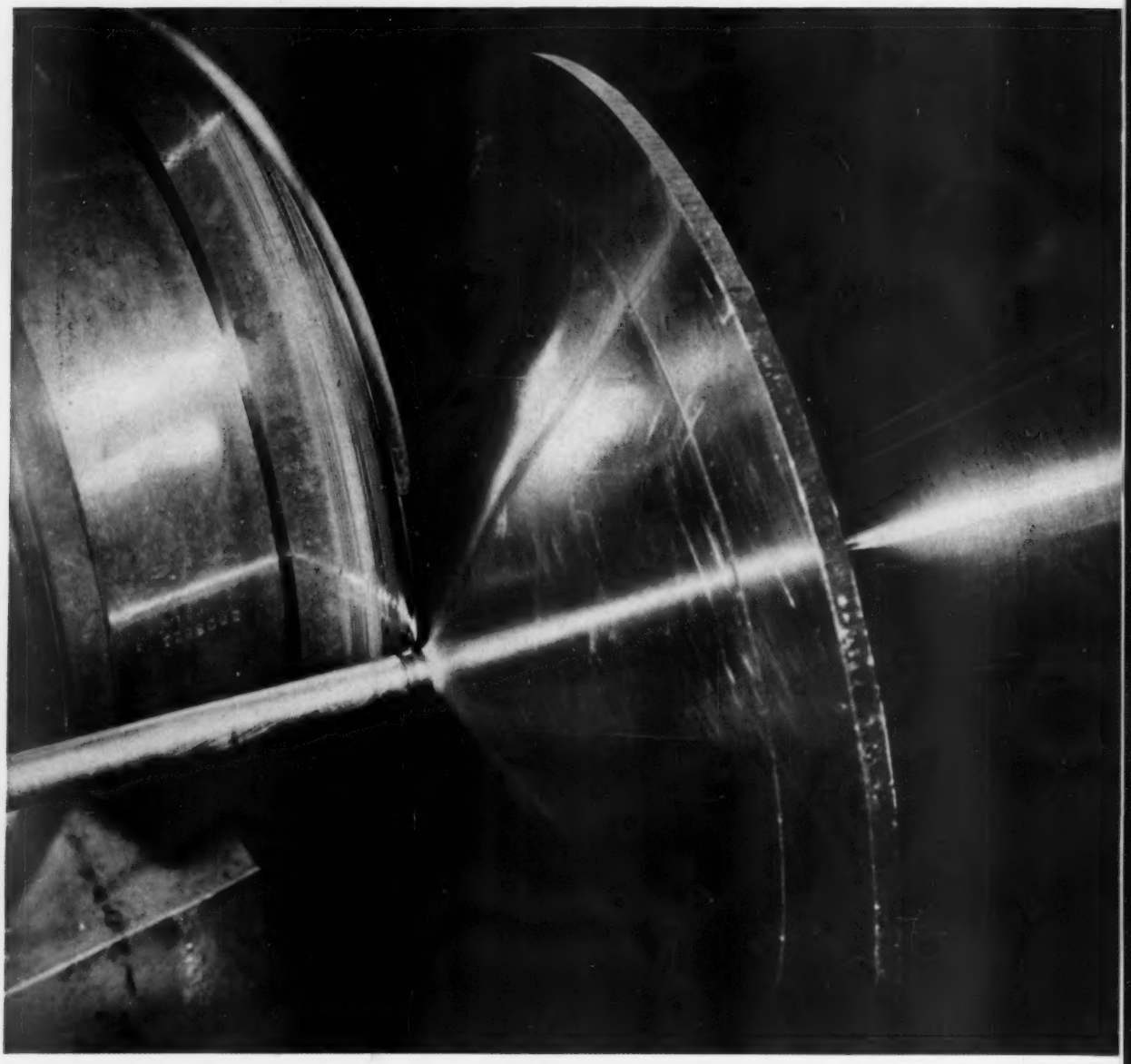


Shear-forming a pointed nose cone, see page 90

- **Winding plastics into shapes,** p81
- **How to automate a chucker or bar automatic,** p86
- **Pneumatic chip removal,** Special Report, p95

CONTOUR BORIZING...

Adding Accuracy for Tape Control

by R. W. Mason
Chief Inspector
The Heald Machine Company

Three years of design and manufacturing experience and an outstanding background of performance records, on tape-controlled Model S Bore-Matics, have made two things clearly evident.

First – accuracy and reliability of these contour Borizing machines have proved to be outstanding. Tolerances of ± .0001 are repeatedly obtained in routine production.

Second – these results stem from a design and manufacturing accuracy which produce a unique machine capable of utilizing the full potential of today's most advanced numerical control systems.

To obtain this accuracy in building the machine, unusual manufacturing and assembly procedures are required and exceptional quality control and inspection techniques are employed. Some of these are of particular interest.

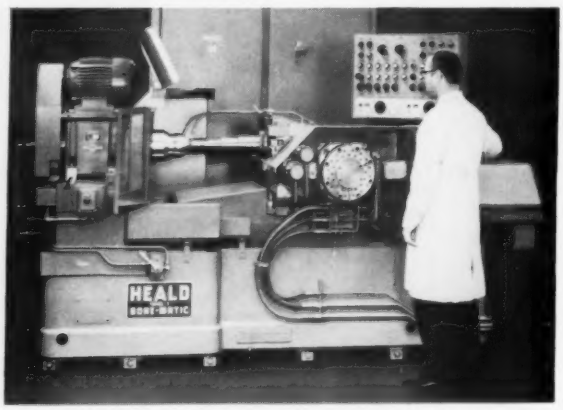
To prevent dimensional changes due to thermal effects during machine assembly, all work is done under controlled temperature in an air-conditioned room. To prevent strain and distortion, all screws on critical assemblies are tightened with torque wrenches to pre-determined design pressures.

All elements of straightness, alignment and tracking are measured with an Auto-Collimator which compares the work to a beam of light and reads to an accuracy of 0.1 of a second of arc (one second of arc is equal to .000005 per inch of length). All dimensional measurements are made with electronic indicators.

Hardened steel ways are assembled and honed in place to a straightness of .000050 or less, in their full length. Table and cross slide are actuated, in increments as small as .000025, by high-precision pre-loaded anti-friction ball screws. Bearing diameters for these ball screw assemblies are bored and honed *in place* on the machine, to assure precise alignment with the ways.

Tracking along each of the two axes is measured in two planes – horizontal and vertical – and must be accurate within .000025 in their full length of travel.

Obviously control measures such as these are not conducive to mass-production methods or other cost-cutting expedients. However, the results are well worth the extra effort. These machines track and repeat to the full potential of the numerical control system, sustaining production required for today's high precision contour boring and turning operations.



Heald tape-controlled Model S Bore-Matic for boring and turning irregularly-shaped work with a dimensional accuracy of ± .0001 or better.

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

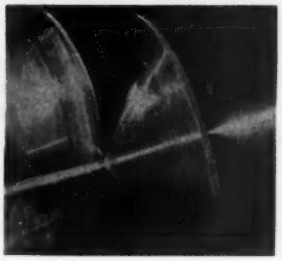
Subsidiary of The Cincinnati Milling Machine Co.

WORCESTER 6, MASSACHUSETTS

CIRCLE 251 READER SERVICE CARD

COVER:

Pointed nose cone for Army missile is shear-formed on Lodge & Shipley Floturn lathe at Minneapolis-Honeywell's Ordnance Division. *See page 90*



American Machinist / *Metalworking Manufacturing*

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SPECIAL REPORT NUMBER 509

Pneumatic chip removal—a case study . . . Here is a solution to high-volume chip removal problems and a close look at how the system was designed. *By Alfred J Marchlewski, Anaconda American Brass Co.* **95**

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TURN PAGE FOR METALWORKING REPORT ——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials— direct from our own staff and round-the-world news bureaus

FLAME CUTTING . . . Numerically controlled flame cutter is completely automatic, works from punched tape, and eliminates templets. The new machine, introduced by Air Reduction Sales Co, Inc, has **four torches that cut straight lines and curves;** torch position is held within 1/64 in. of true position by the General Electric Mark Century control on the machine. **In addition, the tape controls auxiliary functions** such as starting and stopping, turning gases on and off, igniting preheat flames. The prototype machine has a bridge-type structure and will cut up to 6-in. plate over a 20 by 40-ft area. See p.85.

CUTTING . . . Twist drills with radially positioned cutting edges have proven 35 to 45% stronger than drills with conventional cutting-edge geometry, according to a recent Russian report. The Russians have also been experimenting with chipbreaker grooves on these drills, and their work seems to be following the same lines taken by several American and British companies. The grooves — besides breaking up the chips — are **reported to increase the rigidity of the drill, thus permitting increased feed rates.**

FINISHING . . . A coating material that contains 97% pure electrolytic zinc can be applied by brush, spray, or dip, according to Galvicon Corp, Brooklyn, NY. Because it **combines with the base metal to actually galvanize iron or steel,** Galvicon gives complete cathodic protection. When it is applied directly over adherent rust or scale, this coating induces the rusted area to create its own non-flaking coating; therefore, it **stops further rusting and prevents rust creep.** This material, which can be applied directly over welds, is used in the auto industry for rocker panels and unitized bodies.

PLASTIC WINDINGS . . . Not only missile components but also many commonplace items such as water tanks, ducts, fishing rods, and boat masts are counted among the present or potential products that **can be made by winding plastic-impregnated filaments or tapes on mandrels.** A pair of articles starting on page 81 tells why this type of construction is gaining popularity and gives a step-by-step account of how one such operation is performed.

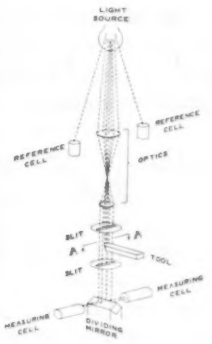
SAFETY . . . Burning metals can be readily extinguished with a eutectic mixture developed by a British firm (John Kerr Ltd). Designed to control ignited uranium, plutonium, and thorium, the **mixture works well with magnesium and its alloys.** The powdered inorganic chlorides and/or fluorides are inert to the burning metal, have a lower melting point.

MATERIALS HANDLING . . . Significant boosts in handling speed are possible with a sheetmetal sorter that has a capacity of 2000 lb. Developed by Edgcomb Steel, the machine rolls on a track, picks up a specified number of sheets from a stack, and carries them to a skid, onto which it automatically dumps them. In one recent test, **the machine moved 235 large aluminum sheets in six minutes;** manually, this would have taken seven hours.

931

CUTTING . . . A quick, dependable, and repeatable test of grinding wheel hardness has been developed by the Macklin Co (Jackson, Mich) and the University of Michigan. Small amounts of abrasive are crushed from the surface of a grinding wheel by rolling contact with a hardened steel wheel; then, the force exerted perpendicular to the wheel surface is measured with a dynamometer. With other variables held constant, **crushing force increases with increased hardness, finer grit size, and closer grain spacing.** Macklin is reported to have just marketed a commercial tester based on this principle.

INSPECTION . . . New gage locates tool point to 0.000,025 in. relative to workpiece, according to the Heald Machine Co, Worcester, Mass. Combining optical and electronic methods, it does not require more operator skill than that needed to run machine on which it is used. **"Eyeballing" errors are eliminated,** because only a simple lining-up operation is required to bring tool point to exact location. Also, **there is no tool point damage like that associated with the touch or contact method of setting,** since no physical contact is made with tool point itself (see schematic diagram). Company says that **return and repeatability are positive** on this gage designed for high precision Borizing applications using single point tooling.



WELDING . . . Punched tape selects heat and pressure settings for a series of different welds on a new spotwelding machine developed by the Weldmatic Div of Unitek, Monrovia, Calif. **Ten combinations** of weld energy (adjustable up to 80-watt-sec) and electrode force (4 oz to 15 lb) **can be set up on the control panel;** then the tape is prepared to select any of them in any desired order for the welding run. The **operator simply puts the correct fixtures in the right order and operates the foot switch.** Called the PAWS-1, the unit was developed for small electronic applications.

FORMING . . . Billets of Rene 41 and molybdenum are formed into pancake shape—without cracking—in a one-shot Dynapak operation, reports the Advanced Products Department of General Dynamics. Three-inch billets of each material are flattened into 9-in.-dia pancakes, **a shape that the Air Force needs to produce larger, complex parts.**

HEAT TREATING . . . Exact microsecond regulation of power output and operating temperatures for electric furnaces is provided by C I Hayes' transistorized constant-phase control unit. **Measuring only 7 x 9 x 3 in.,** the unit is said to **cost only a fraction as much as comparable control devices** and to save up to 75% of the space normally required by electronic tubes, mag-amps, reactors, and powerstats that serve the same general purpose as this miniaturized component.

Continued on next page

Coming in AM/MM

- *55 cost-cutting ideas*
- *One machine replaces five*
- *Close-tolerance flame cutting*

METALWORKING REPORT . . .

INSPECTION . . . A long, thin ribbon of optical fibers transmits light into "hot" reactors and takes a picture of any cracks, corrosion, or other faults. The probe—being built by Optics Technology, Inc, Belmont, Calif for delivery this summer to a company in Pittsburgh—is **made of five aligned layers of optical fibers,** each of which measures 1500 strands (3 in.) wide and one strand (0.002 in.) thick. **It will read 200 inches per minute along the 3-in.-wide path, with a reported resolution of 2 mils.**

WELDING . . . Friction welding goes to work on its first commercial job in the free world, welding some 1000 oil-field joints (1.750-in. dia) to 1¼-in. (nominal) tubing at American Iron & Machine Works Co, Inc (Oklahoma City), a subsidiary of American Machine & Foundry Co of New York. Even though the friction welder is a prototype machine, the company claims **20 welds an hour, which it says is comparable to flashwelding and far exceeds pressure welding.** Machine was developed by AMF's Research & Development Div.

MATERIALS . . . Industrial diamonds are being made by the explosive working of graphite at Stanford Research Institute in Menlo Park, Calif. When graphite is placed over a container of water and exposed to an explosive charge from above, it **receives a shock pressure of about 300,000 atmospheres.** Diamonds up to 40 microns in size—obtained from the resulting material—are found to **have the polycrystalline structure most desirable for industrial cutting and grinding.** Although yields are presently only 5 to 10% of total material, research indicates that higher yields and larger diamonds are possible.

FORMING . . . Half-inch-thick Inconel X is being cold-spun to form rocket-booster-nozzle jackets. After the 0.500 ± 0.015-in. material is rolled and welded to form a 40-in.-dia cylinder, it is cold-spun on a modified Liefeld 96-in.-swing spinning/planishing lathe. **Spinning reduces the 40-in. diameter to 36 in. at the nozzle throat section.** Spun part is then heat treated, machined to finished wall-thickness dimensions, and X-ray inspected.

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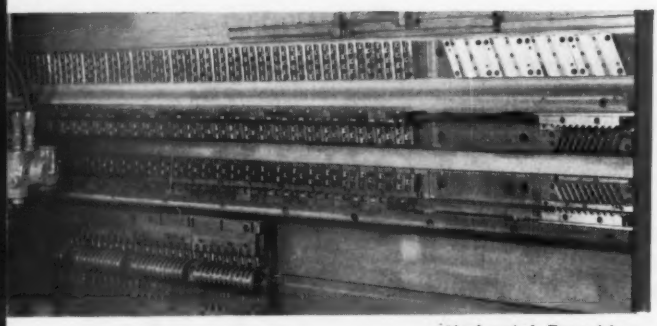
CINCINNATI's

Long Experience in Surface Broaching Applied to *Chain Type* Machines

Chain Broaching*

CINCINNATI metal cutting research has done much to advance surface broaching. During the early thirties Cincinnati developed the broaching of automotive cylinder blocks and heads. Great strides in the method, in the machines and tooling have been made since then. Cost-saving throw-away tool bits, an exclusive Cincinnati development, are employed to broach bearing caps and cylinder blocks and heads. Other examples of Cincinnati ingenuity in surface broaching include long business machine spacing bars, using a unique shuttling motion during the return stroke of the ram . . . parts having heavy stock, requiring multiple cuts . . . copper switch components for large switchboards . . . frail crankshaft bearing shells . . . tiny movie camera parts . . . parts produced automatically, at a production rate of several hundred per hour and also those produced at very low production rates.

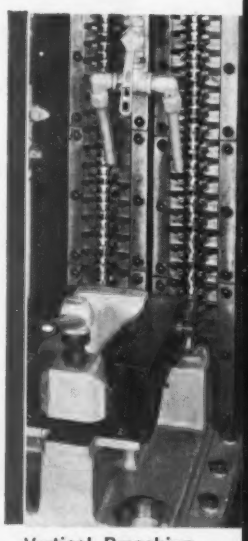


Horizontal Broaching

To satisfy this wide range of industry requirements, Cincinnati builds three types of surface broaching machines;

1. ***Vertical,*** single ram and duplex, from 1 to 25 tons broaching force.
2. ***Horizontal,*** one-way and two-way, 10 to 100 tons broaching force.
3. ***Chain,*** the newest type, described in detail on the next two pages.

Cincinnati Broaching Specialists are ready to help you reduce costs. May we hear from you? **The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



Vertical Broaching

**Chain Broaching photo courtesy of Lawrence Brothers, Inc., Sterling, Illinois*

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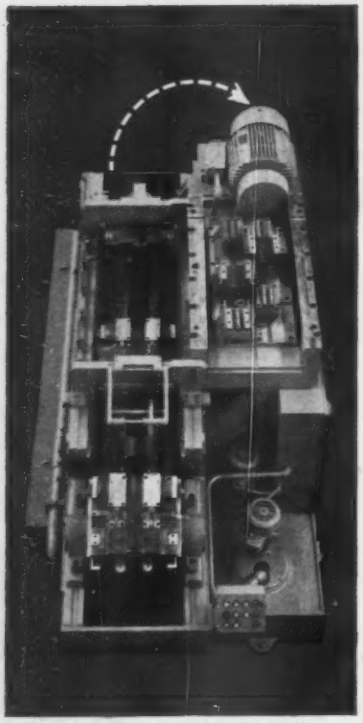
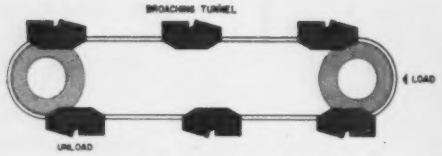
New CINCINNATI *Chain Broach*

IS ADAPTABLE TO CHANGE



Removal of broach inserts (cutting tools) for re-grinding is facilitated by merely opening the hinged top, as illustrated here.



Chain broach principle: a closed loop continuous production cycle. Fixtures indicated in red can be replaced or more added.

CHAIN BROACHING implies very high production. But very high production equipment sometimes limits design changes in the part. New CINCINNATI Chain Broach Machines retain the high production characteristics of closed loop cycles while adding a new advantage . . . they're adaptable to change. A unique method of attaching the work-holding fixture to the chains permits a welcome freedom of replacing or adding fixtures.

Straight-line traverse of fixtures through the broaching "tunnel" is assured by extra rugged guide bars. A pressurized coolant system and an endless conveyor automatically remove chips. To facilitate maintenance and adjustment of broach inserts (cutters), the top of the broaching tunnel is hinged and can be readily opened.

The CINCINNATI Chain Broach illustrated above is tooled up to

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THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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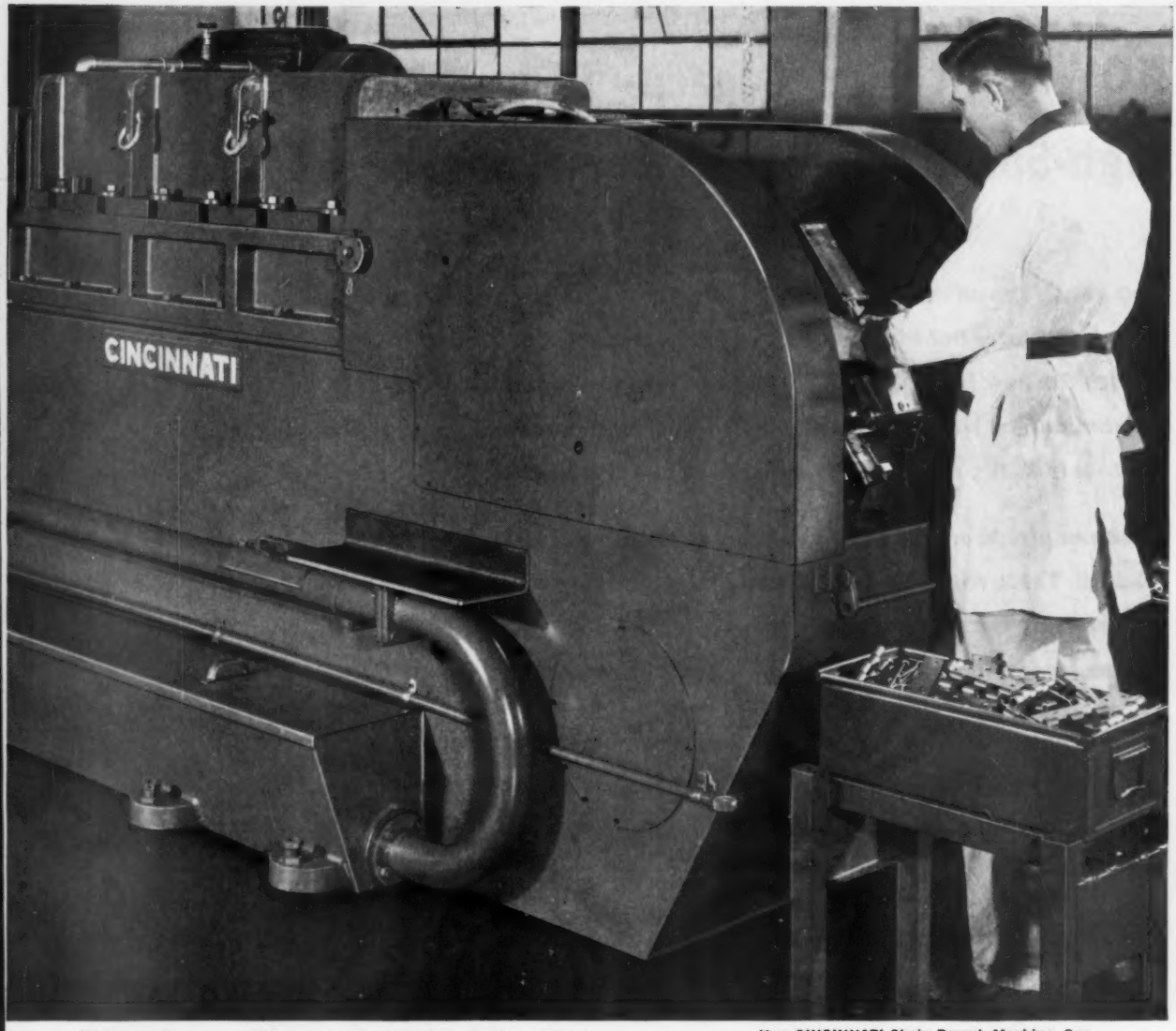
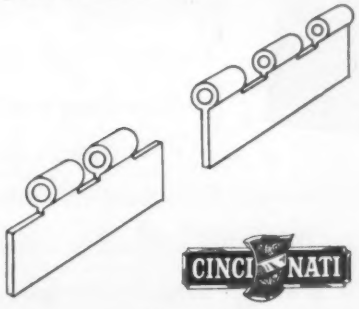


Photograph courtesy of Lawrence Brothers, Inc., Sterling, Illinois

broach door hinges for a prominent Illinois manufacturer of builders' hardware. Interchangeable fixture elements accommodate several sizes. With the exception of manual loading, the complete cycle is automatic and continuous, resulting in a production rate of 924 hinge leaves per hour.

The new Chain Broach Machine is a typical example of advanced thinking and modern approach to low-cost production which Cincinnati imparts to broaching and other metalworking machines and production lines. Many specialists in Cincinnati's Special Machine Division are available to study your machining problems and recommend equipment to reduce costs and improve quality. May we give you more information?

New CINCINNATI Chain Broach Machine. Can be built in various sizes and tooled up for many types of high production jobs, such as machining the door hinge leaves shown below. Automatic chip disposal system is seen at front of machine.



COMPLETELY AUTOMATED PRODUCTION LINES

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NOW... A Larger Capacity FELLOWS-PFAUTER High-Speed Hobbing Machine... The P 630

You get all the advanced-design features of the production-proved P 400 Fellows-Pfauter hobbing machine — plus extra work capacity — with the new Model P 630. Takes work up to a diameter of 25". Maximum face width at 25" diameter is 16¼". Maximum diametral pitch in steel is 3. It's fast, easy-to-handle . . . and it's built for high production.

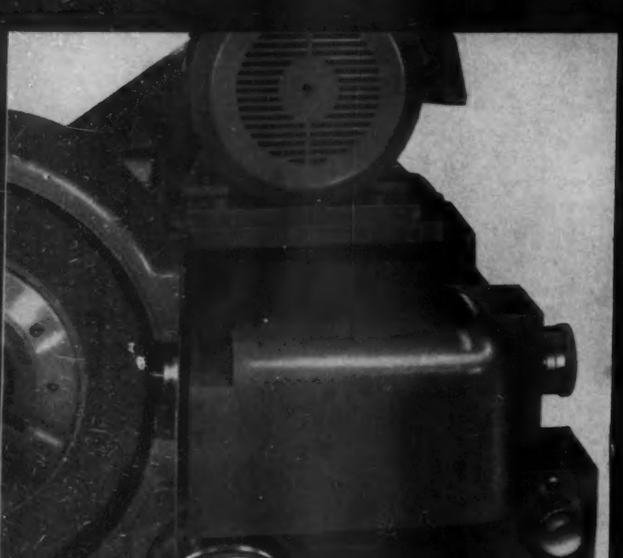
For example: Work area is readily accessible for setup and loading. Table retracts automatically from hob to facilitate work changes. Hob shifting is controlled by pushbutton. And built-in hydraulics assure smooth operation of tailstock and fixtures.

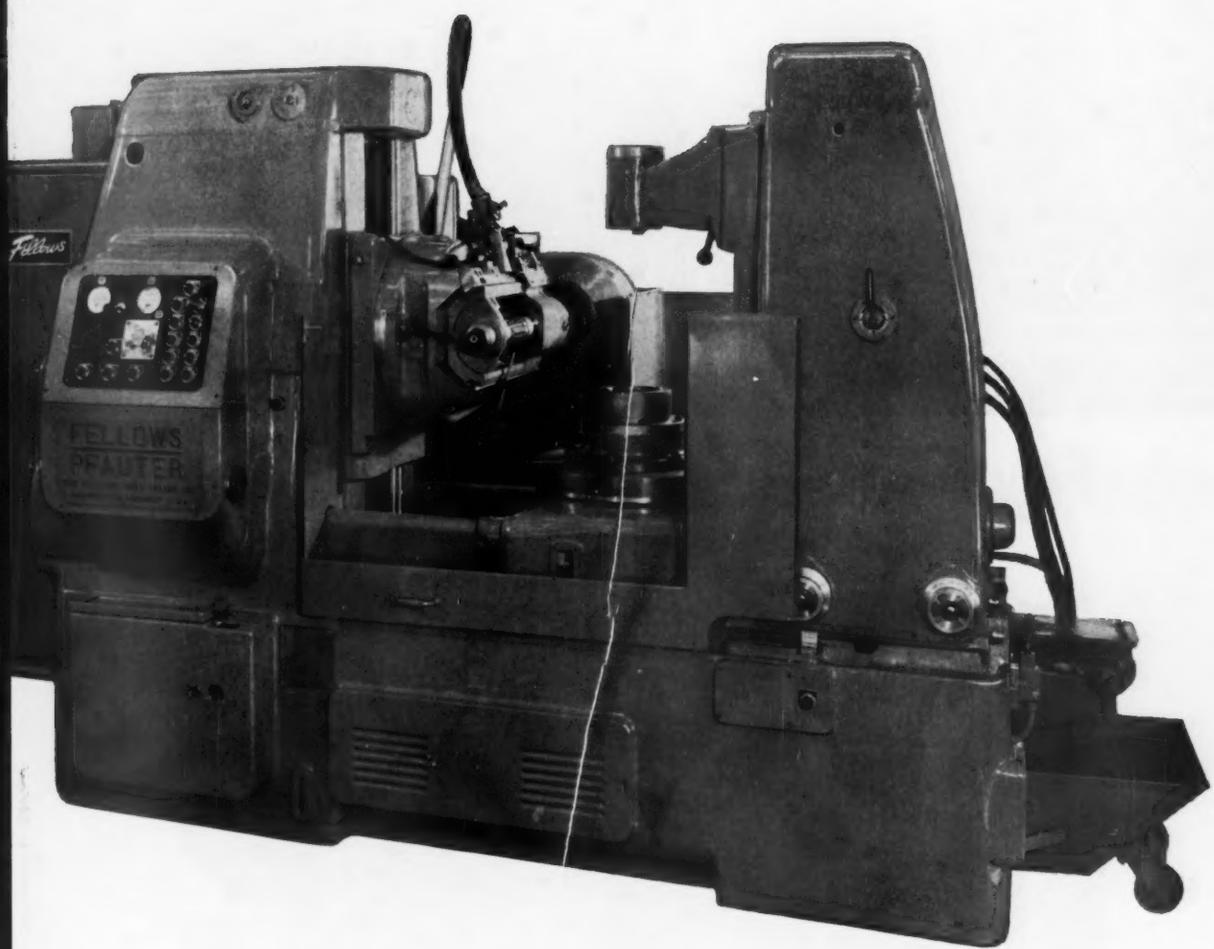
Solid construction features include: rugged hob head and double wall construction column and bed, with heavy V-ways. Table is as large as maximum workpiece diameter, and index worm gear nearly as large as work table. Work column is of massive design.

Reduce your production costs with this new Fellows-Pfauter. Get complete details now.

NEW... Dictionary of Change-Gear Combinations

Eliminate tedious calculations and trial-and-error methods for finding change gear combinations. Now, simply look them up like words in a dictionary in "Fellows-Pfauter Change Gear Tables" by F. Becher and A. Koerner. This English edition contains combinations for more than 26,000 ratios carried to six decimal places from .100,000 to 1.000,000, with the greatest step approximately .00005. Change gears in the range of 18 to 80 teeth are mainly used. Examples of applications are given. Only $8.00. Get a copy now. Send your order to THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont, U. S. A.





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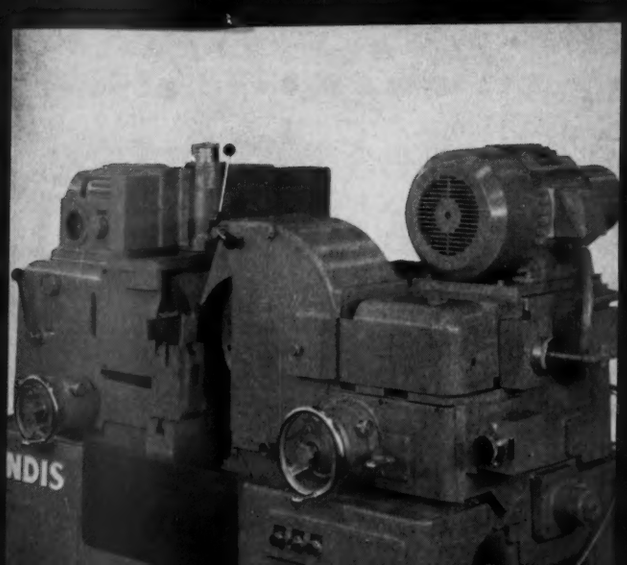
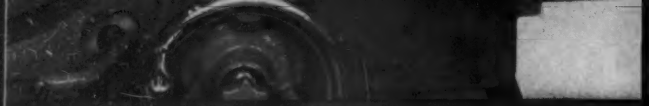
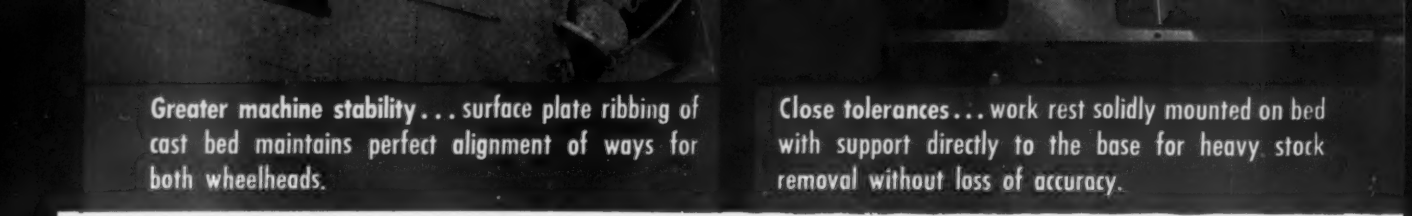




New dressing accuracy . . . Landis Truform dresser with preloaded ball slides, gives exact duplication of the profile on the wheel.

Faster grinding cycles . . . New and exclusive Landis Lockspeed drive for regulating wheel gives quicker sparkout and rounder work.

Four outstanding advantages of



Greater machine stability... surface plate ribbing of cast bed maintains perfect alignment of ways for both wheelheads.

Close tolerances... work rest solidly mounted on bed with support directly to the base for heavy stock removal without loss of accuracy.

the allNEW Landis centerless grinder

This completely new 12R machine is the finest centerless grinder available anywhere in the world. It will grind parts at a faster rate and to even closer tolerances than was possible before.

LANDIS

world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.

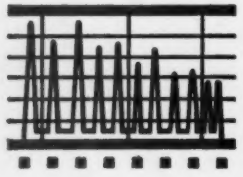
IF you want to control

and improve the quality of your product

with measurements displayed

on a dial . . . in an air column

or in signal lights

on a panel or a chart 

there'll be no IF in the results

when you measure with Sheffield gages

The SHEFFIELD Corporation Dayton 1, Ohio

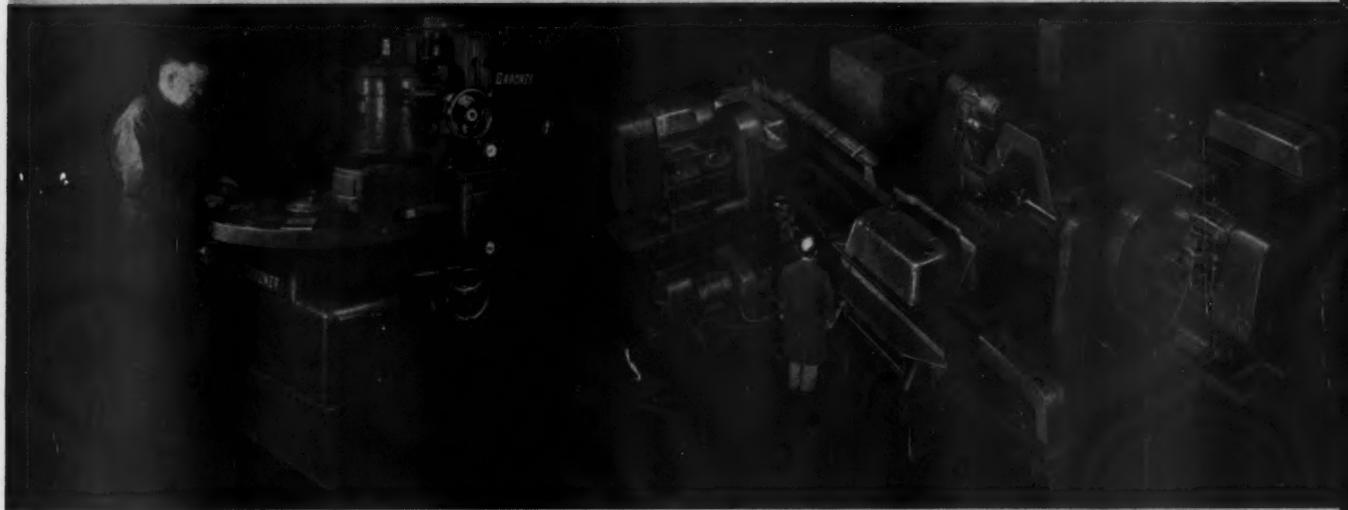
A subsidiary of The Bendix Corporation

from the world's most complete line of disc grinders:

standard and specially engineered machines for a wide variety of disc grinding jobs

Consistently close tolerances, high rate of production on precision double spindle disc grinders. Five sizes available.

Single spindle disc grinders for production grinding single surfaces. Manual and power operated work-carrying fixtures available.



Grind small precision parts at high production on this vertical double spindle disc grinder which grinds two surfaces parallel in one operation.

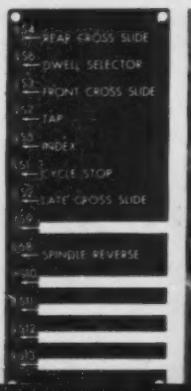
Grind unusual workpieces—like bathtubs—on Gardner Special Purpose Grinders which grind surfaces parallel, generate curved surfaces, single or multiple surfaces.

GARDNER

precision disc grinders

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

a subsidiary of Landis Tool Company



Running medium to large lot sizes, one operator can easily handle more than one O-AC. Typical "AC" design permits use of standard shank-type turret lathe tools for complex work. Large number of tool stations often eliminates extra operations, handling of work pieces. O-AC has ample power and rigidity for heavy metal removal.

Fast setup lets you automate small-lot orders. Speeds, feeds and stroke lengths are set by placing trip blocks on Speed and Feed Control Drum (1). Pins screwed into Index Control Drum (2) regulate functions shown on plate at left. Supplementary Control Drum (3) regulates slight variations of standard machine functions—dwell, feed start—late cross slide, rapid traverse reverse, etc.

New chucker automates production of small precision parts

O-AC Single Spindle Automatic easily holds tenths. Accuracy, plus fast setup, rigidity and power give you a one-operation, precision automatic for all lot sizes.

This is more than a new "AC". This is the *smallest* "AC". It can profitably automate the jobs you now assign to precision hand-operated machines.

O-AC holds exacting tolerances on parts like these, proves practical on lot sizes once considered economical only for hand-operated machines.

Along with precision machining capabilities, you'll find we've built in all the setup, tooling and operating features that have proved their worth on our larger Automatics.

Thus you can use the O-AC to complete more jobs in one operation, combining multiple-tooled turret stations with cross-slide cuts. And, of course, you can schedule more jobs on the O-AC because it produces profitably on even very small lots.

Does the O-AC belong in your shop? The Field Engineer is the man to ask. Or write The Warner & Swasey Company, Cleveland 3, Ohio.

MAJOR SPECIFICATIONS

SWING	
Over cross slides	6"
CHUCK DIAMETER	
Air operated	6"
WORKING STROKES	
Pentagon turret	5½"
Cross slides	1½"
SPINDLE SPEEDS	
Four ranges	87-2507 rpm
FEEDS	
Three automatic selections from 18 feeds (.001 to .083)	
Threading range	11½-48 tpi
MOTOR	
Reversing type	5 or 7½ hp

YOU CAN TURN IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

The Westinghouse man with the motors brings you—

New Class B Insulation to give you 15% more horsepower on totally-enclosed Life-Line motors

16 CIRCLE 265 READER SERVICE CARD

Now Class "B" Insulation replaces Class "A" *as standard* on totally-enclosed 1-250 hp Life-Line a-c motors giving you these advantages:

Added capacity . . . Operation at 15% over nameplate rating without reduction in motor life.

Longer life . . . 80% to 100% longer life at rated loads than motors with Class "A" Insulation.

This newly designed motor is engineered to give top performance in a wide range of applications. On-the-line experience in the steel industry, where maximum reliability is essential, has proved its higher output, longer life and lower maintenance under the toughest conditions.

For the ultimate in protection specify Guardistor* on all Westinghouse motors. This exclusive built-in static motor protection allows the use of maximum horsepower over long periods with no danger of motor burnout.† For additional information ask for booklet B-7876-A.

Your Westinghouse sales engineer can supply you with complete details on these money-saving motors. Call him for full information on how they can fit into your production scheme. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

You can be sure . . . if it's Westinghouse.

*Trademark

Westinghouse

†Warranty: Westinghouse GUARDISTOR MOTORS on frames 182-445 inclusive are guaranteed for one year against burnouts due to overheating resulting from: overload, locked rotor, blocked ventilation, bearing seizure, single phasing, unusual duty cycle, high ambient, or voltage unbalance, providing the Guardistor elements are connected in a control circuit so that the motor is removed from the power source in the event of over-temperature.

J-22170

Time is the measure of productivity

Time is the measure of productivity
Time is the measure of productivity

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Time is the measure of productivity

Reduce grinding time and you increase productivity. Norton's many time saving innovations in varied stages of grinding production can reduce your grinding time up to 30%! The story is a profitable one. Here's why —

Norton Grinding Machines are engineered to permit higher wheel speeds to reduce cutting time. Norton's *Automatic Wheel Balancer* balances the wheel in *five seconds—on the machine.* You reduce time spent "grinding air" up to 85% because of Norton's *Automatic Wheel Contact Accelerator* which speeds the wheel to the work and compensates for work piece-diameter variation. Another advance is Norton's *Automatic Truing* which eliminates work interruptions and the *Automatic Wheel Wear Compensator* that stabilizes the grinding cycle.

Norton Grinders further add to your productivity by minimizing work spoilage with *Automatic In-Process Gaging.* In the case of surface grinders Norton *Higher Table Speed of 150 fpm* actually reduces grinding time up to 50%.

These are only some of the many reasons you can increase your productivity with Norton Grinders. They also offer accessories that literally transfer skills to machines — *ultra-fine feed,* and *automatic features* such as *steady resting, endwise locating, loading, constant peripheral wheel speed* and *hydraulically-operated feed screws* provide this competitive advantage.

The decision is yours — can you afford not to reduce the time it takes to produce your product? Can you afford not to increase your productivity? Contact your Norton man, NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines

NORTON
MACHINE TOOLS

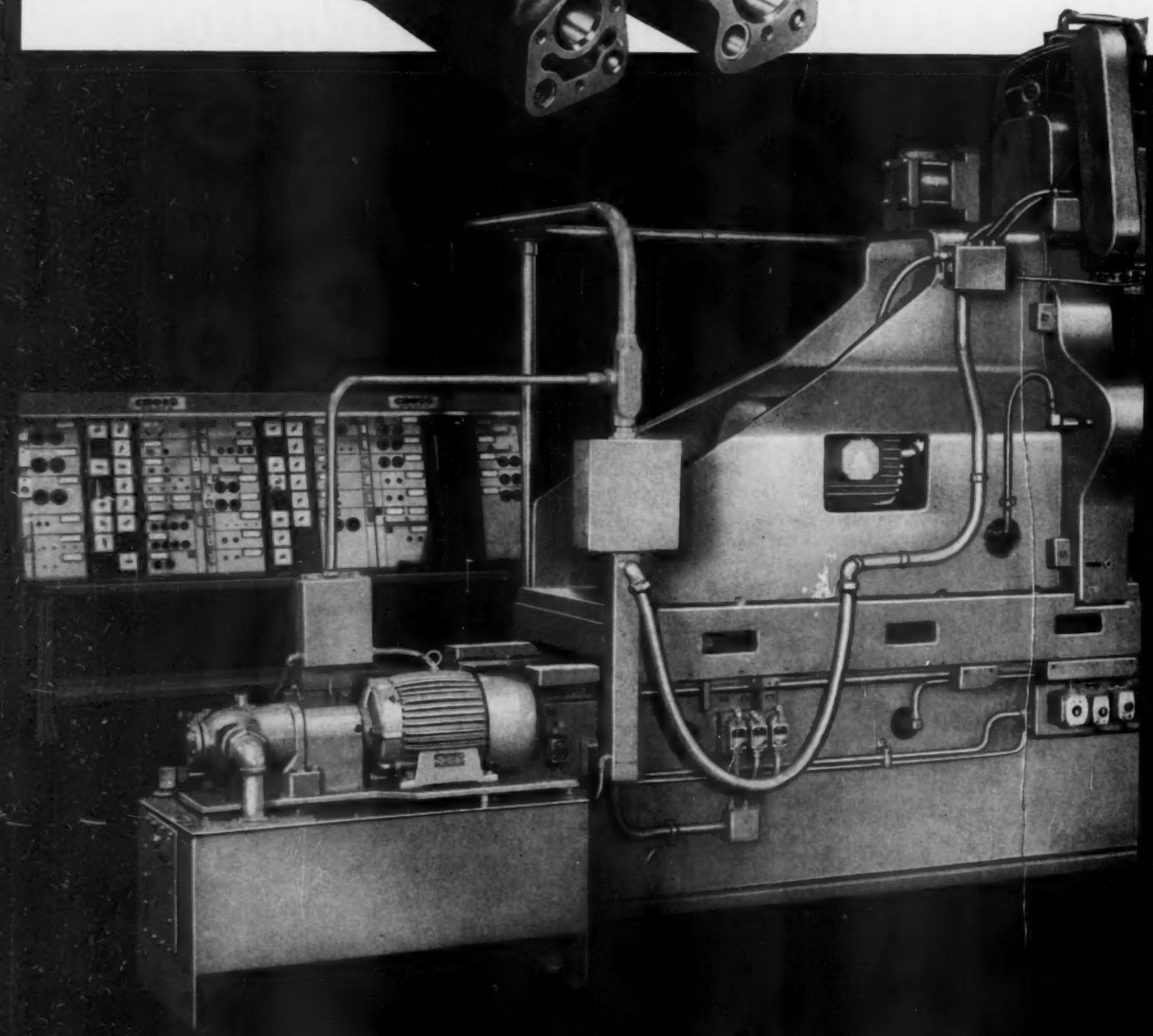
Making better products . . . to make your products better

CIRCLE 268 READER SERVICE CARD ▲

CIRCLE 269 READER SERVICE CARD ►

New Cross Trunnion Machine with Greater Flexibility

Processes remote accessory cylinders of different designs and different materials



Another Automation First by Cross

Recent developments by Cross have resulted in trunnion machines that perform a variety of operations on families of parts with improved accuracy and at a higher rate of production than previous equipment.

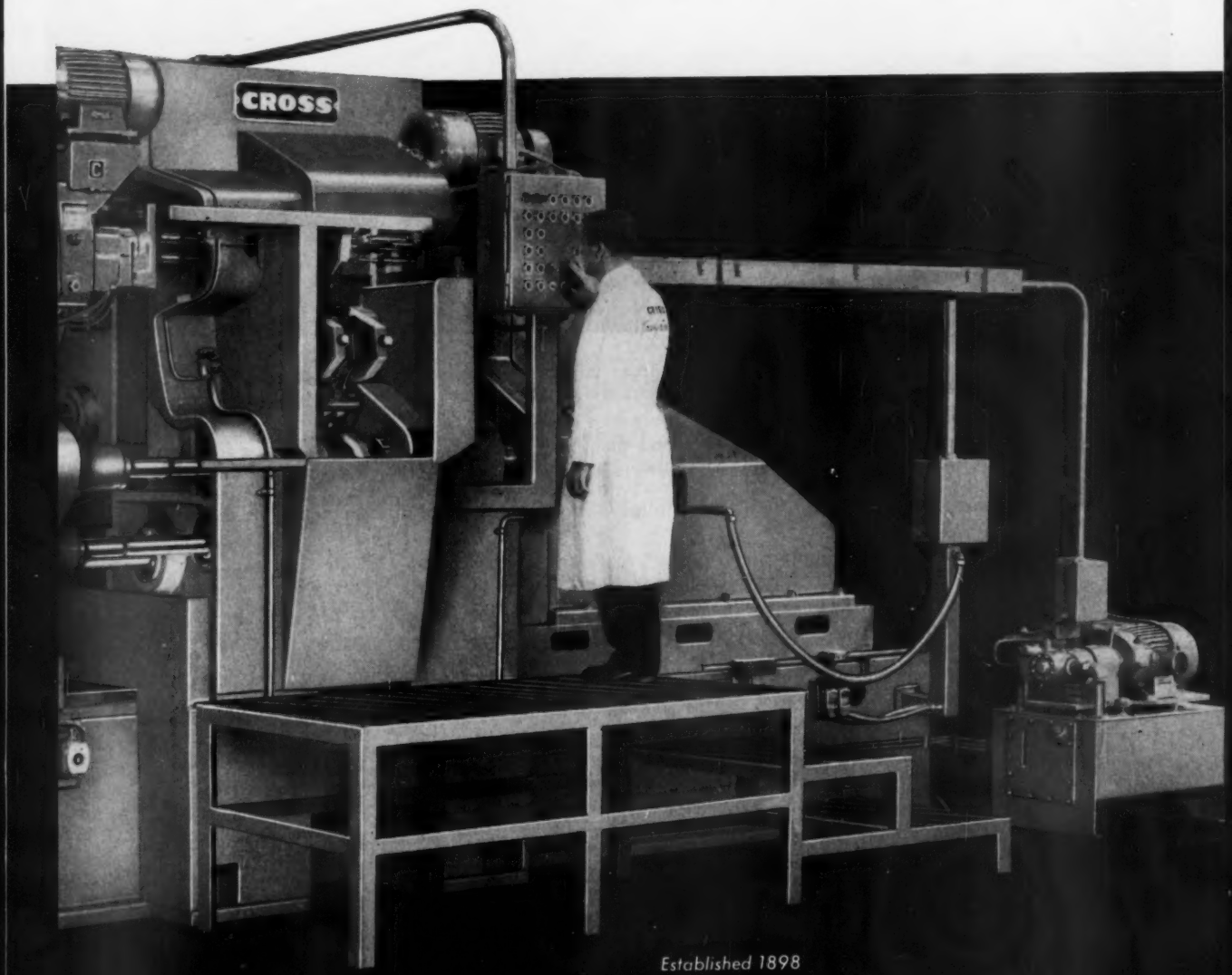
A typical application of the new design concept is the processing of remote accessory cylinders which vary in both size and material. Different lengths are handled by changing a few tools, replacing some fixture details and adjusting the feed strokes. Both nodular and grey iron castings are processed by changing the speeds and feeds.

Similar operations such as rough, semi-finish and finish boring; drilling; counterboring and chamfering are completed by spindles in the two main heads. Dissimilar work such as tapping, facing and grooving are done by four auxiliary heads.

Extremely close tolerances are maintained through single clamping of the part, precision indexing of the trunnion and boring bars which are accurately guided in the trunnion supports.

Future part design changes can be accommodated easily because of the extreme flexibility of the machine.

A Cross Sales Engineer will be glad to tell you more about this new trunnion machine design.



Established 1898

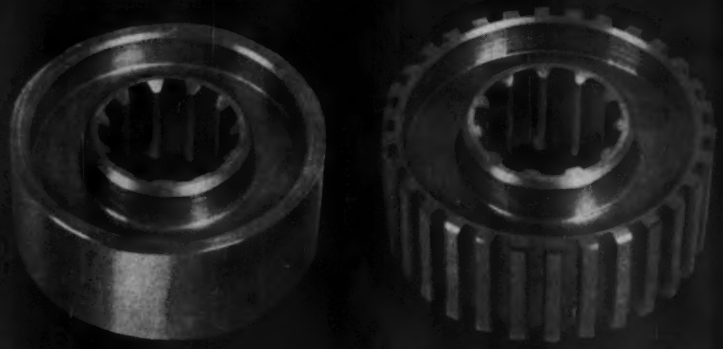
THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

In a "pot type" broach . . . 30 involute teeth on the O.D. of this large transmission gear

LAPOINTE — BROACHED in 20 seconds!



Transmission Gear before and after broaching involute teeth on O.D.

This is not the kind of job that you'd ordinarily put through a "pot type" broach. It's a long cut, there's a heavy stock removal factor, and what's extremely important: *you need plenty of rigidity.*

But Lapointe-Broaching did it . . . and there isn't any way to do it quicker! The involute teeth on the O.D. are rough- and finish-broached with a set of *individual cutter-bar broach inserts* in the Lapointe "pot type" broach, instead of using a form blade. The set-up is easier, sharpening is simple. Completely automatic broaching and unloading account for the high production rate.

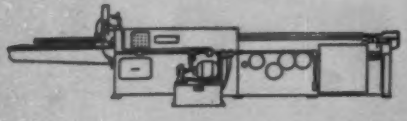
This is another of those "tough jobs", made easy by Lapointe-Broaching. You should talk to one of our qualified Field Engineers about some of your own production problems, because *the greatest potential for cost reduction exists in the field of broaching.*

THE LAPOINTE MACHINE TOOL COMPANY

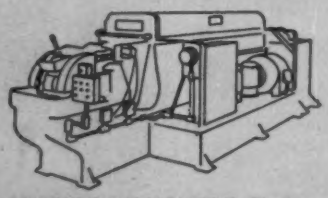
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

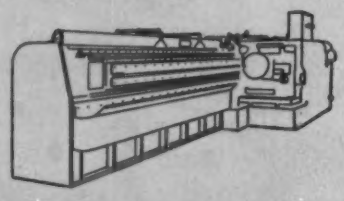
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



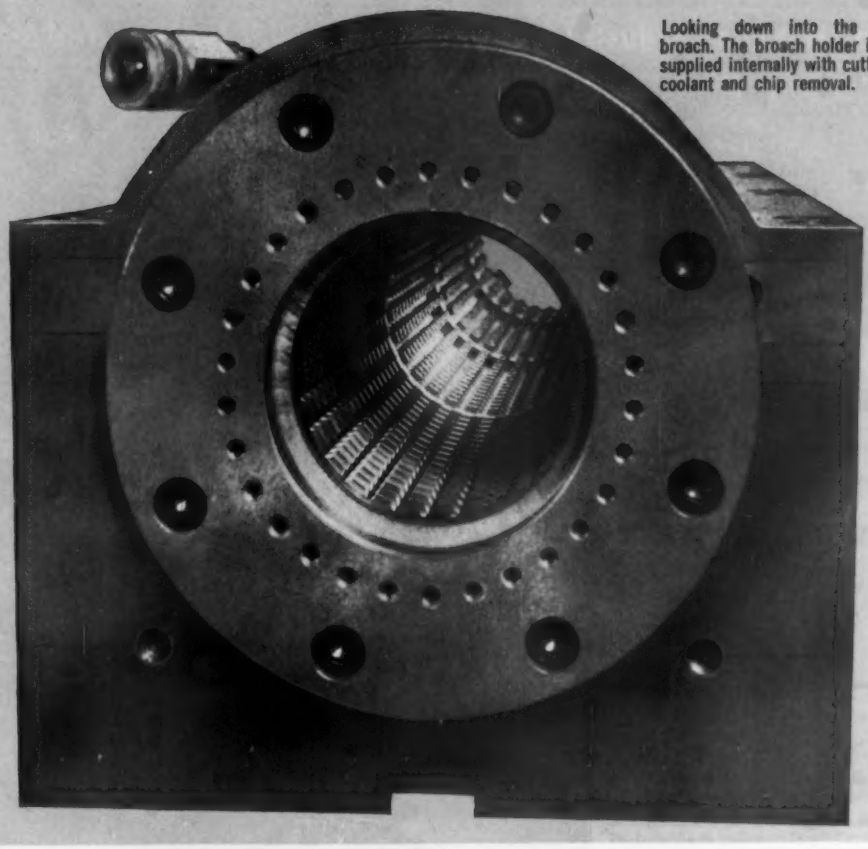
CH CONTINUOUS BROACHING, ELECTRIC



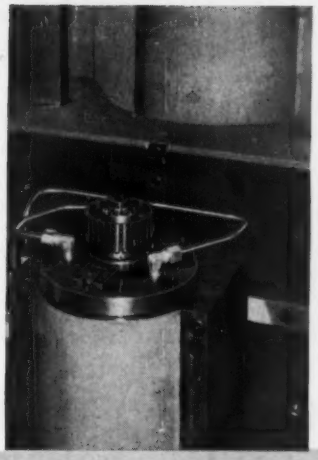
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

CIRCLE 270 READER SERVICE CARD

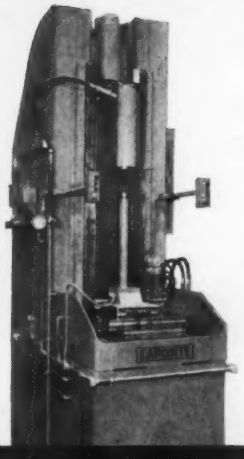
CIRCLE 271 READER SERVICE CARD



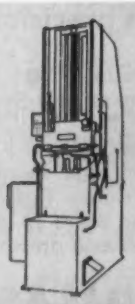
Looking down into the "pot type" broach. The broach holder is constantly supplied internally with cutting fluid for coolant and chip removal.



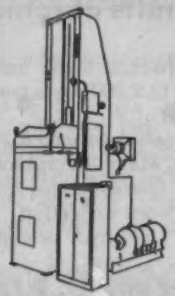
Finished gear shown after being broached by the Lapointe "pot type" broach. Locating from one of the teeth on the internal spline, the part is mounted on a mandrel of a special Lapointe In-and-Out fixture, over an expanding arbor. Note the slide on which the broach assembly is mounted, for extra rigidity.



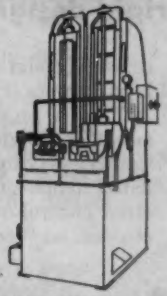
Lapointe Single Ram Vertical Broaching Machine (SRV), 15-Ton, 66-inch Stroke



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



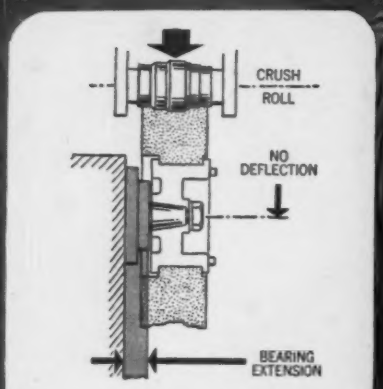
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

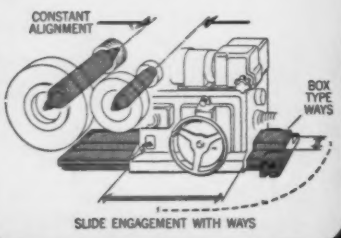
BROACHING

Van Norman's Industry-Integrated Design Has Industry Talking!



Rugged, heavy Grinding Wheel Spindle with its additional bearing extension withstands the terrific pressures of crush roll forming with NO DEFLECTION.

Maintained alignment of Grinding and Regulating Wheel Spindles is assured by the high engagement ratio of the Regulating Wheel Slide length to width.



HOW MICRO SWITCH FINISH GRINDS SMALL

Van Norman Centerless Grinders meet rigid design limits of famous precision

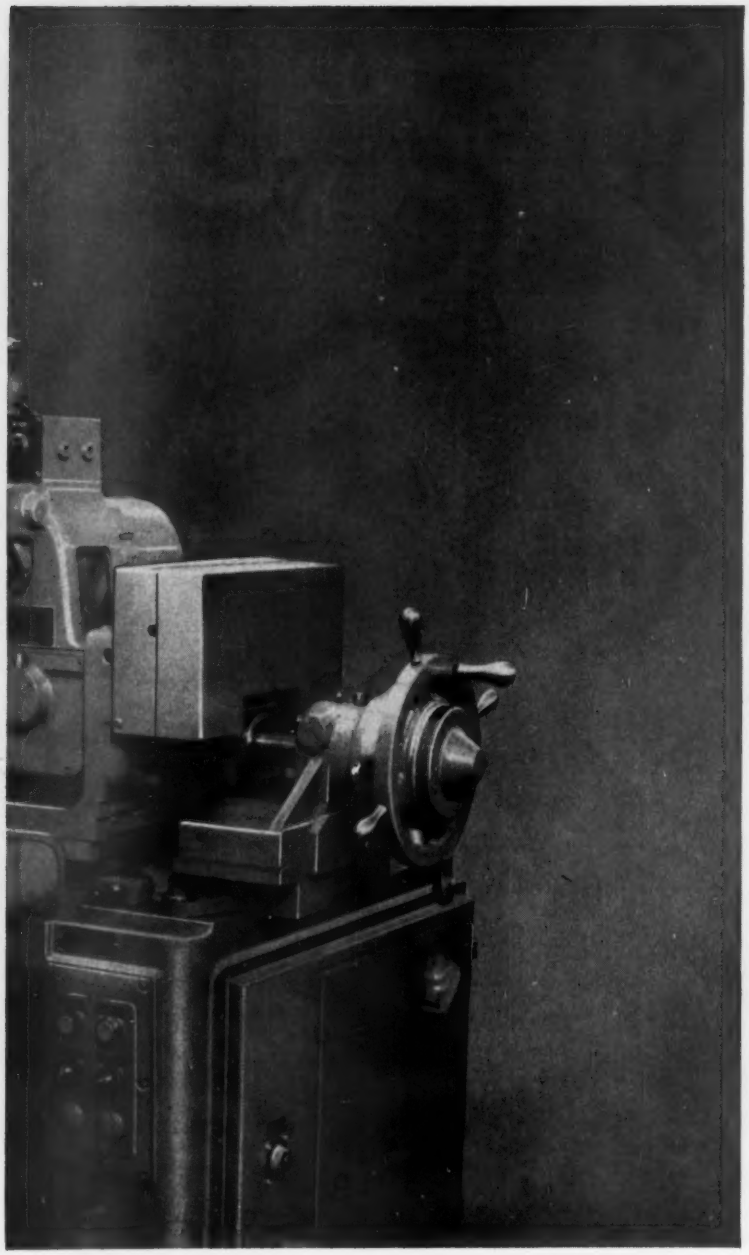
Close tolerances in vital parts are indispensable to MICRO SWITCH, suppliers of over 12,000 types of precision switches to home, industry, defense. This division of Minneapolis-Honeywell Regulator Co. gets accuracy and economy with VN Grinders.

.0001" on Thru-Feed—.0002" on Infeed are met by VN units in volume-grinding actuator shafts and plungers for snap-action switches. Specs for multi-diameter concentricity and micro-inch finish are routinely held at high outputs (1,000 to 2,000 parts per hour on thru-feed; 120 to 250 on infeed).

Fast, Smooth, Vibrationless Operation is designed into VN Centerless Grinders. Massive construction—well-coordinated components—lifetime-sealed spindle units. Result: strict control over work deflection . . . no warm-up, no chatter. no "creep." VN hyd. profile diamond dressing

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS



PARTS TO .0001"

snap-switches at high output-rate

on both wheels, with cams for straight or multi-diameter parts.

Variable Speeds, Easy Set-Up, Operation Control. Two regulating wheel speed ranges: 13-80 and 140-830 RPM. Capacity 0-1½" dia. Optional: VN Crush Dressing Attachment.

Free Booklet—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

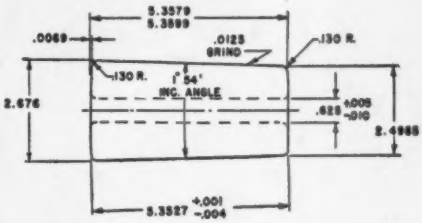
MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

Another typical Van Norman centerless grinder cost-saving application

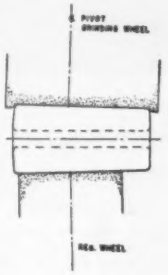
CUSTOMER'S PROBLEM:



To grind taper on large roller bearing, including blending radii on both ends. Parts to be green ground, hardened, then finish ground. Customer wanted to increase production as well as get more pieces per dress. Runout limit required: .0001" minimum. Finish to be 15 RMS or better. Previous operation produced approximately 17 pieces per dress on rough grind, and approximately 25 on finish grind. Stock removal was .020" to .025" on rough grind, and .005" on finish grind.

VAN NORMAN SOLUTION

Crush grinding the taper and radii simultaneously. Then finish grinding the radii, leaving .005" on the O.D. After heat treating—grinding the O.D. only, removing .005" of stock and holding a 15 RMS by diamond dressing the wheel.



THE RESULT:

Rough grinding is performed in 30 seconds, with the removal of .020" to .025" on the O.D. and approximately .005" on the radii. Pieces per dress: 160, and without visible signs of taper or chatter. Finish grinding rate is 7.7 seconds per cycle, with 245 pieces per dress, and a 9 to 12 RMS held without runout or chatter. This exceptional accomplishment is one more example of how production efficiency can be stepped-up through the application of Van Norman Centerless Grinders.

2609

set a new standard

Bay State has just completed a concentrated research and engineering program designed to make Bay State mounted wheels the finest available anywhere. Results are paying off for users in more uniform grinding action . . . easier operation . . . and virtually complete elimination of defective materials and workmanship. These wheels are as nearly perfect as the most advanced abrasive technology can make them.

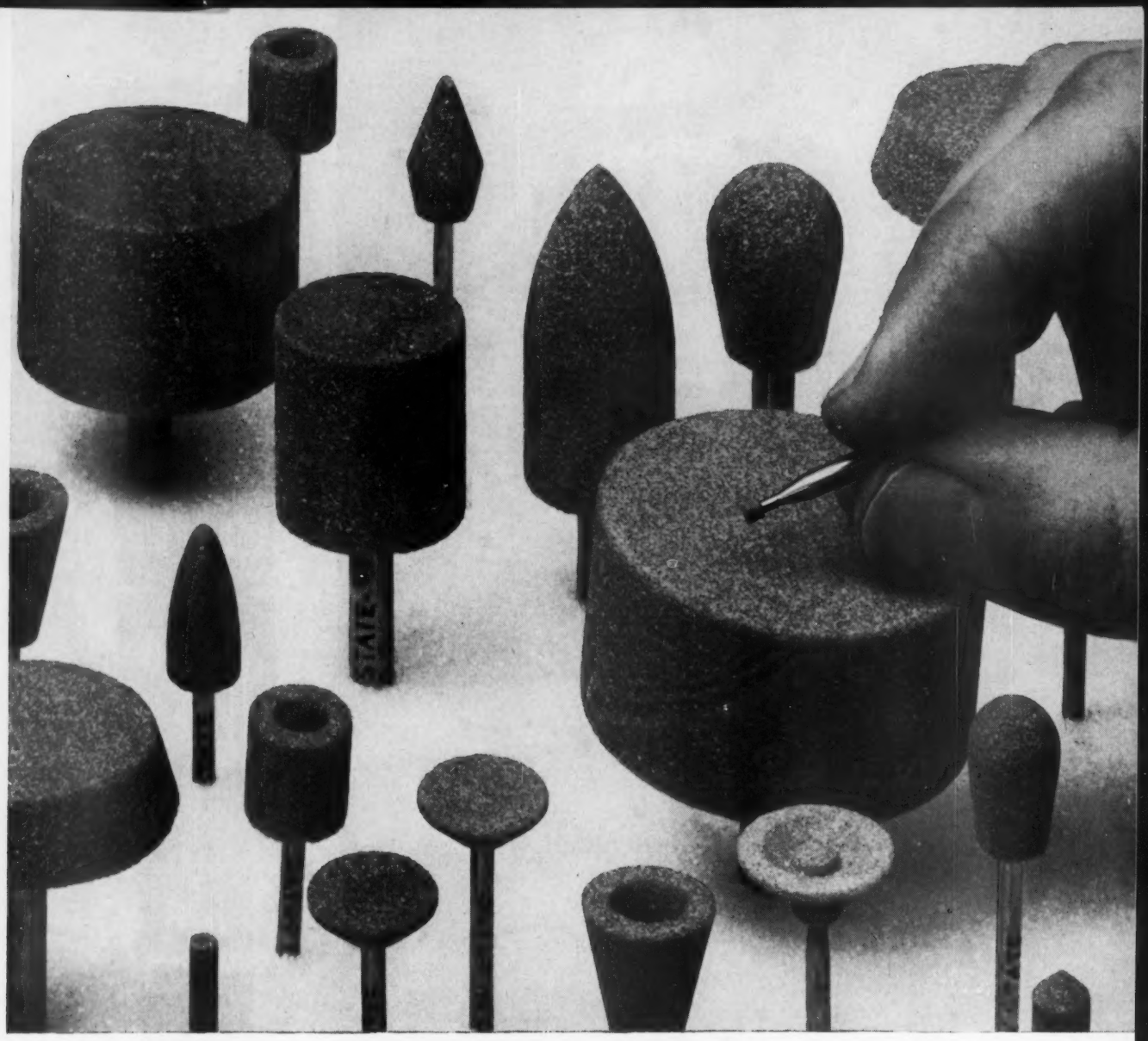
POSITIVE WHEEL-TO-MANDREL BOND Deeply knurled mandrel ends and specially formulated bonding material weld wheel and mandrel into a single, rock-solid unit. Constant, rigid quality control tests are made to check this Bay State feature.

SUPER-ACCURATE CONCENTRICITY Every wheel is molded oversize and then *ground to shape on its own mandrel* so that it *automatically* becomes perfectly symmetrical and is perfectly concentric with the center of the mandrel itself. *Result:* Every wheel runs true from start to finish . . . no breaking in required . . . no hard spots, no soft spots, the whole wheel does a 100% job of grinding right down to the mandrel.

BAY STATE
WHEELS of PROGRESS

BAY STATE

CIRCLE 275 READER SERVICE CARD

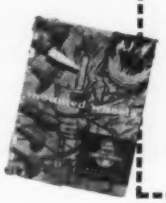


# of excellence for the industry

MAXIMUM MANDREL UNIFORMITY Mandrel diameters are uniform to very close tolerances. No fumbling when operator changes wheels because new wheels can be locked into place with a minimum change in the collet or chuck setting.

COMPLETE INVENTORY IMMEDIATELY AVAILABLE Hundreds of different combinations of shape, grit, size, porosity, bond and mandrel size are in stock, ready to be shipped to users immediately. Bay State's 30-page catalog makes it simple to choose the specs you need for any job.

For special mounted wheels, call your Bay State, direct or distributor, representatives. They are abrasive specialists. *Better grinding at lower cost . . . that is their business.*



Bay State Abrasive Products Co.
Westboro, Mass.

Please send me the new Bay State Mounted Wheel catalog with full technical information on the best mounted wheels available to industry.

Company _____

Name _____

Address _____

City _____ *State* _____

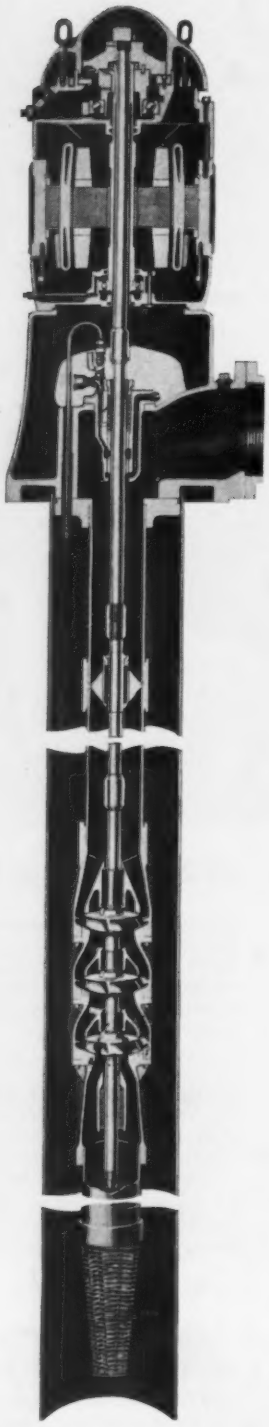
ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CIRCLE 276 READER SERVICE CARD

Steel

Strong
Modern
Dependable



Engineered for emergencies as well as variable demands, three Deming Turbine Pumps serve in Richmond, Missouri, water works. Republic Cold Finished Ground Bars used for pump shafts meet straightness and diameter requirements for precision operation.

CIRCLE 277 READER SERVICE CARD

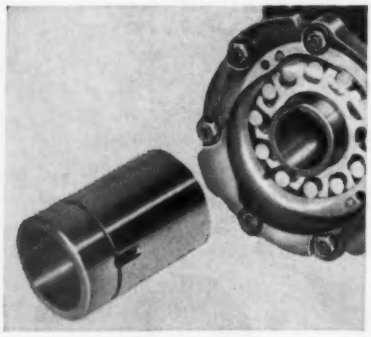
At Deming Company...

Republic Cold Finished Steel Bars consistently meet straightness, tolerance requirements...as received!

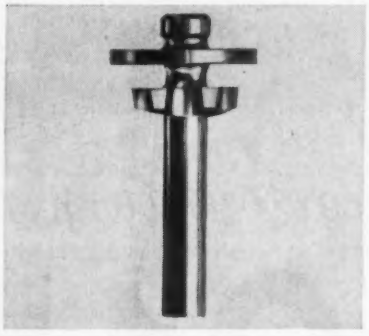
From shipment to shipment, bar to bar, Deming Company, Salem, Ohio, receives Republic Cold Finished Ground Bars that consistently meet or exceed exacting straightness and diameter tolerances, and finish requirements. Republic's exceptional uniformity provides direct cost-cutting benefits because restraightening, handling, and inspecting are greatly reduced.

Deming, one of the country's largest pump manufacturers, uses Republic Stainless and Carbon Steel Bars for shafting in vertical turbine pumps. They maintain a straightness tolerance of .002 total runout on 10-foot shaft sections, and a close diameter tolerance. To meet the precision tolerances that applications of this type demand, Republic uses specialized straightening facilities and techniques.

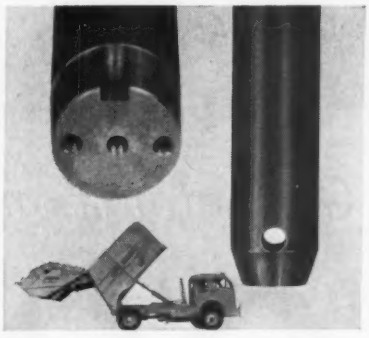
Send the attached coupon for more information and for your copy of an informative free booklet, "*REPUBLIC COLD FINISHED BAR PRODUCTS —a guide to their proper selection.*" It contains a wealth of essential data on the full line of Republic Cold Finished Products, and how you can make use of them to solve your production problems.



SOLVES MACHINING PROBLEM ON POWER STEERING UNIT. Exceptional I.D. and O.D. concentricity of Republic ELECTRUNITE Mechanical Tubing have greatly reduced machining, and cut costs on bushings for power steering units produced by Eaton Manufacturing Co., Cleveland. ELECTRUNITE's structural soundness helps insure flawless performance. Send coupon for information on ELECTRUNITE.



BEATS CORROSION AND WEAR ON MIXING FAUCETS. In manufacture of Hyseal Valve Stems for American-Standard single lever mixing faucets, National Acme Co., Cleveland, required steel with high corrosion resistance and wear resistance, plus easy machinability. Material selection: Republic Cold Finished Stainless Steel Bars—Type 303. Completed in a single setup, 10 machining operations are performed in 12 seconds. Send coupon for information on Republic Stainless.



MEETS REQUIREMENTS FOR HIGH STRENGTH PINS. The full weight of the Packmaster body and its refuse load (up to 5 tons) rests on steel pins at pivot points when the unit is hoisted to unload. Republic Cold Finished Alloy Steel Bars, cut off, drilled, and chamfered by the Packmaster manufacturer, Leach Co., Oshkosh, Wisconsin, offer the toughness and abrasion resistance needed. Investigate Republic Cold Finished Alloy Steel Bars for your parts production.

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

CIRCLE 278 READER SERVICE CARD

REPUBLIC STEEL CORPORATION
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1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

☐ Send free booklet "*REPUBLIC COLD FINISHED BAR PRODUCTS— a guide to their proper selection.*"

More information on:

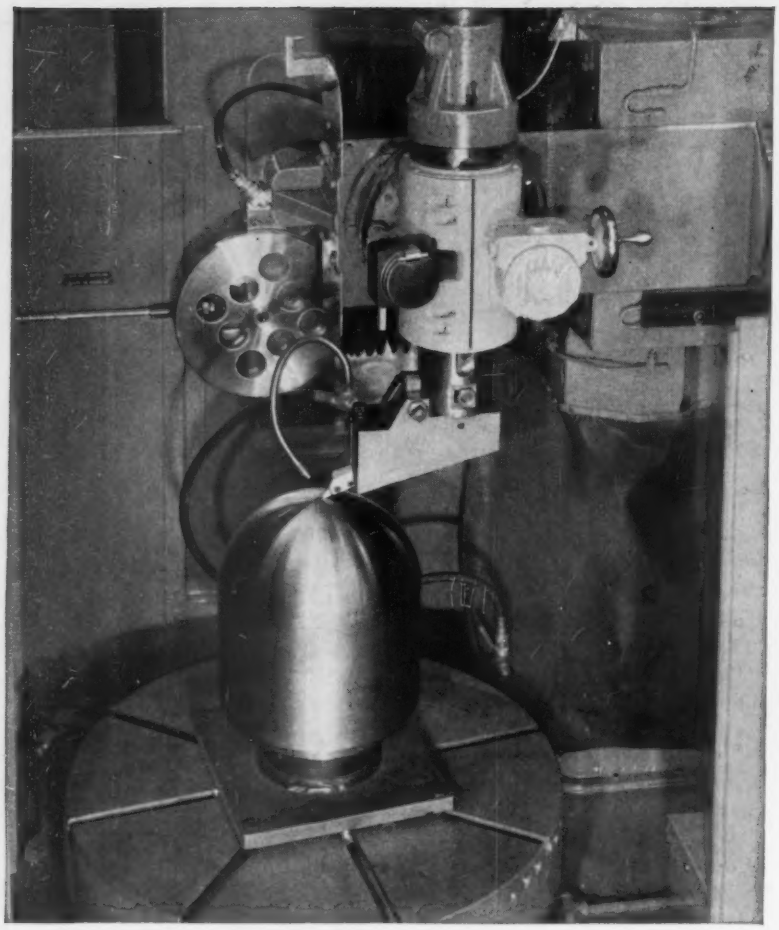
☐ Cold Finished Carbon Steel Bars ☐ Cold Finished Stainless Steel Bars
☐ Cold Finished Alloy Steel Bars ☐ ELECTRUNITE® Mechanical Tubing

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____



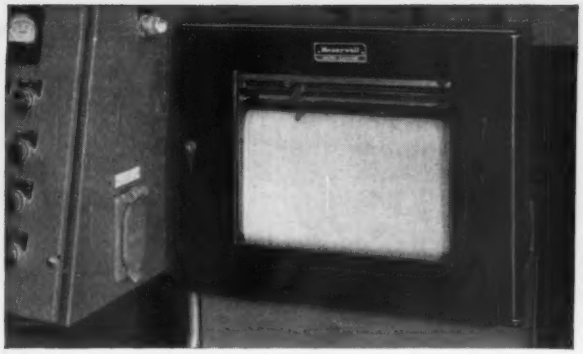
Super-precise turning, boring and grinding machine—A Frauenthal FIRST!

Countdown on contour turning accuracy...

.000150"

GUARANTEED

...even on 30" diameter work pieces!



The new Frauenthal electrohydraulic tracer control incorporates super-precise recording facilities. Recorded are the accuracy of the follower to the tracer template and the machine slides.

This versatile 900 Series machine has a 30″-diameter table with maximum swing of 36″. Maximum vertical slide travel — 32″; maximum vertical travel on manual turret slide — 3″.

The custom-built 900 Series achieves critical contour turning accuracies not available in similar machines. The precision-guaranteed 900 Series will hold a tolerance of ± .000150″ on contoured surfaces, with tolerances as close as ± 100 millionths possible on straight work pieces.

The 900 Series utilizes vertical design to eliminate the deflection normally encountered when unsupported parts are machined in a horizontal position.

Frauenthal's ultramodern electrohydraulic tracer system affords a new high degree of control reliability. Completely transistorized for compactness, it guides the vertical and horizontal travel simultaneously through 360° of motion. Any variation from true contour path is immediately indicated on a continuous recorder which also gives a permanent record of contour turning accuracy.

A numerical control for continuous path or point-to-point positioning is also available.

Enjoying unusual versatility, the new turning and boring unit anticipates machining needs far into the future. The machine will easily adapt to conventional grinding, turning, boring, milling, facing and polishing.

You can bring your most difficult machining problems to Frauenthal with complete confidence. Contact Frauenthal now.

Versatility of vertical machine design cuts floor-to-floor time • Two-axis tracer system holds stock removal constant per revolution regardless of stylus location on the contour • Cast work table with tee slots is ground flat to surface-plate accuracy to insure precise setup, measuring and installation of fixtures • Exceptionally efficient water-type heat exchanger and variable temperature control regulate the hydraulic system temperature within ± 1° to hold oil viscosity and maintain accurate tracing • Automatic force-feed lubrication • Unit can also be equipped for grinding.

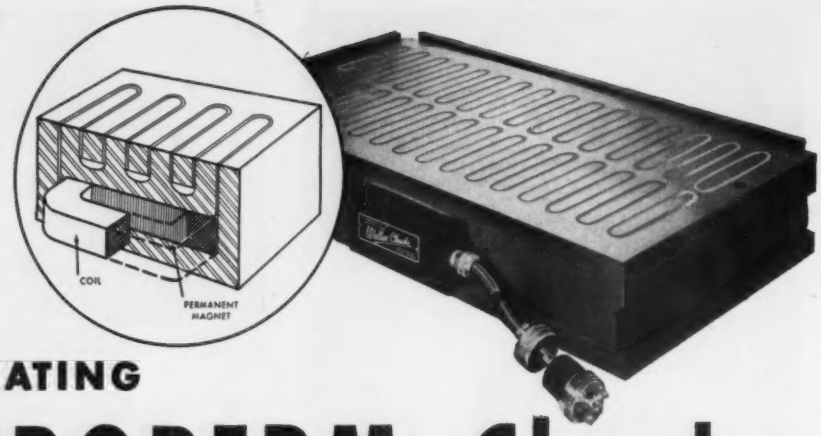
Frauenthal

DIVISION

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U.S.A.

NEW



COLD OPERATING

ELECTROPERM Chucks

Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.

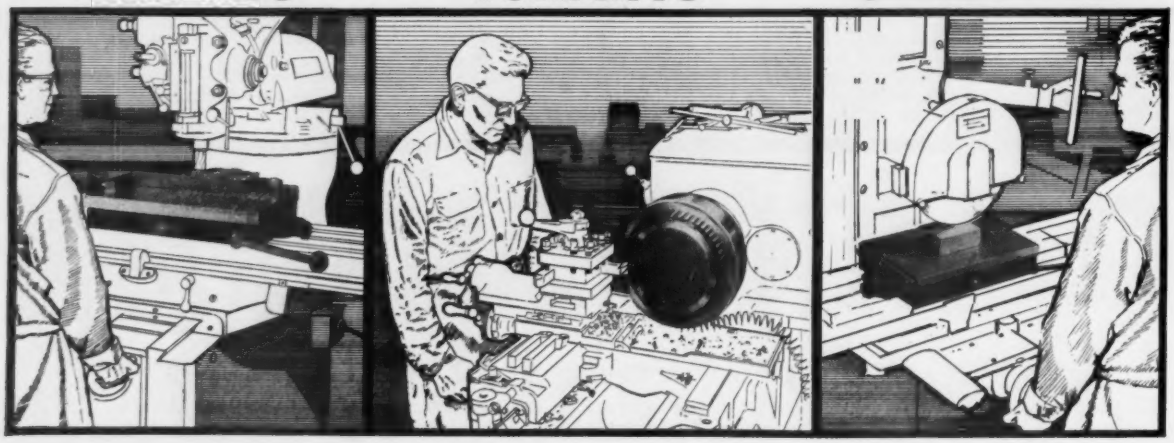
Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

O. S. Walker
COMPANY, INC.
ROCKDALE ST., WORCESTER 6, MASS.

WALKER CERAMAX CHUCKS

Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of *equal* strength keep cutting tools demagnetized.

MILLING **TURNING** **GRINDING**



Production Pointers

from GISHOLT

More cost-cutting IDEAS—
to help you

CALIFORNIA PRESS CUTS TIME 58% ON LARGE QUILL SHAFTS

JETracer . . . smart tooling simplifies complex jobs

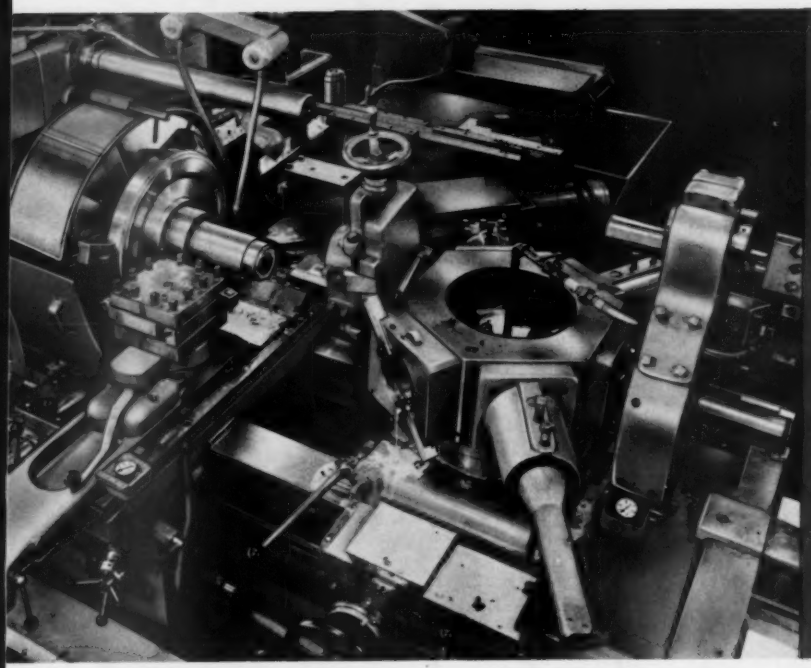
California Press Manufacturing Co., San Francisco, California, uses a Gisholt MASTERLINE® 5L Saddle Type Turret Lathe to produce a variety of large, heavy parts. Other jobs, such as large-diameter, thin-wall rings, are also machined to close tolerances without distortion. Whether your parts are large or small, their method will provide some cost-cutting answers.

Setup and machining is simplified by a JETracer on the rear of a bridge-type cross slide and a cross-feeding hex turret. Tooling costs are reduced because only standard hex turret tools (in most cases), and simple flat templates (to control the JETracer's single-point tool), are needed to provide accuracy and fine finish. Insert-type tool bits keep down-time at a minimum. Dial indicators speed positioning.

This arrangement saves 7½ hours on the quill shaft shown. Material is cast steel, SAE 4140, annealed and heat-treated to 22-25 Rc. To eliminate possible distortion, it is machined in three operations. *One* tool setup handles all *three*, with only minor tool adjustments between operations. Total f.t.f. time . . . only 5½ hours. Details are given in the photo captions.

Smart setup cuts quill shaft machining time 58%. JETracer and C/F hex turret eliminate costly form tools . . . minimize operator skill . . . improve accuracy . . . simplify inspection, for similar saving on all parts.

For information on 5L and JETracer, circle No. 756.



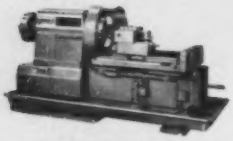
QUILL SHAFT (20¾" Diameter, 15¾" Long) MACHINED OVER-ALL IN 3 OPERATIONS WITH SETUP SHOWN AT LEFT

Operation 1—rough quill end: hex turret—rough turn quill with special holder (center of photo) and complete 11" long, 3⅛" bore; square turret—rough turn various quill diameters, face, form, undercut back of flange removing up to 1" stock. Time . . . 60 minutes f.t.f.

Operation 2—rough and finish flange end: hex turret—multiple head (far right) turns O.D., co-bores and forms . . . other stations machine various other steps in bore; square turret—finish all fit diameters, step faces, chamfers and radii. Time . . . 3 hours f.t.f.

Operation 3—finish quill end: JETracer finish traces length of quill (two passes) with center support from hex turret; square turret—undercut, groove and thread quill end using side carriage chasing attachment; hex turret—finish bore and chamfer. Time . . . 1½ hours f.t.f.

PREMATURE MACHINE OBSOLESCENCE SOLVED



Simplimatics have flexibility for present and future needs

If you have parts that call for special or multiple-spindle machines, you'll want to study this story. The decisions reached by a major automotive manufacturer may provide some answers to your problems.

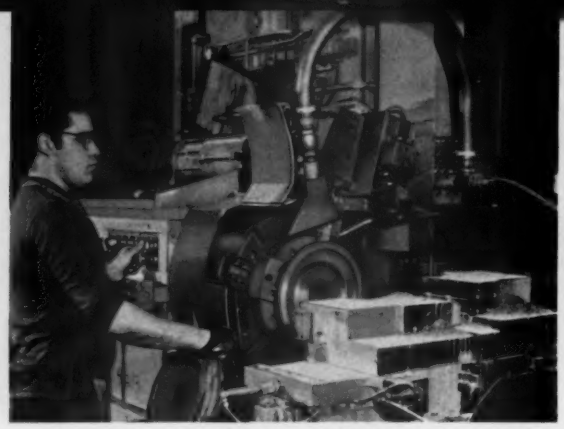
In tooling up to produce 5 different sizes of flywheels, the advantages, costs, and production rates of standard and special or multiple-spindle machines were carefully weighed. Eight *standard* Simplimatics were purchased because they met the requirements listed below at *standard* machine prices.

FLEXIBILITY . . . Each Simplimatic has a wide, screw-fed platen upon which *standard* independent slides with tool blocks can be positioned to suit the work. Two machines have a headstock-mounted auxiliary slide for machining behind the leading edge of the work. To meet varying production needs, all tool blocks for front, rear, and auxiliary slides have locating keyways and stops and are *completely interchangeable* between machines.

MINIMUM DOWN-TIME . . . Templates were supplied so that all but the boring tools could be *pre-set* in master blocks. Throw-away insert tools are used wherever possible. When a tool dulls, the operator can quickly index to a new edge or replace it with another pre-set tool, locating against ground surfaces in the tool block.

OBSOLESENCE . . . Tool blocks can be easily modified with minimum effort and cost to produce any existing or *future* part design.

PRODUCTION . . . Simplimatic completes maximum surfaces per cycle. Caption provides machining details.

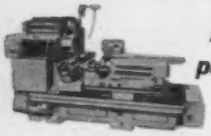


First operation on 13.250″ flywheel. Table feed bores, turns O.D. from front slide . . . standard movement faces. Table feed co-bores and shaves bevel from rear slide . . . standard movement faces, chamfers and shave-turns ring gear diameter. Auxiliary slide sizes ring gear diameter. Eleven tools machine 13 surfaces at approximately 300 sfm. Time . . . only 1.30 minutes.

Simplimatics give you top production rates, peak versatility at standard machine prices. Tooling . . . not machine . . . can be modified at low cost for new work.

For information on Simplimatic, circle No. 757.

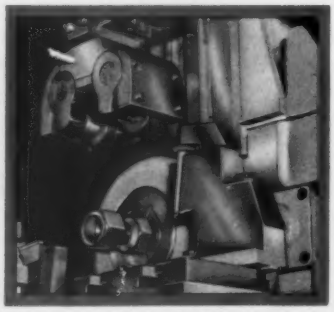
L&L COMBINES OPERATIONS FOR 60% TIME SAVINGS



AR Turret Lathes produce finished parts from bar stock—automatically

This setup shows how you can reduce costs on bar work—involving both internal and external threading, forming and cut-off operations. With it, L & L Manufacturing Company, Warren, Michigan, cut machining time on intermediate size runs an average of 60% on over 1500 different types of pipe and tube fittings, made from round, square, and hex C-1119 steel bar stock.

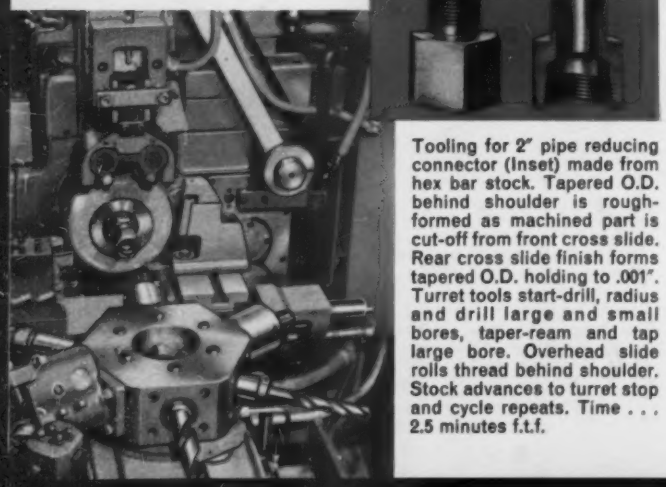
Equipment selection played an important part in obtaining these savings. Competitive machines were evaluated with these objectives in mind: Complete automatic operation; use of solid taps, self opening dies, and thread rollers during same cycle; tooling capacity to complete parts in one cycle; range and number of speeds for maximum metal removal and optimum tool life; rigidity for forming cuts; quick setup; and initial cost.



Overhead slide rolls thread behind hex shoulder. Used for cut-off operations on certain other parts.

As a result, three Gisholt 5AR Turret Lathes were purchased. One 4½″ and two 2½″ capacity machines were needed to handle product mix. All were equipped with an extra tool slide, mounted on the headstock, above the spindle. One 2½″ machine has an octagon turret. This gave L & L a choice of 9 or 11 tooling stations so that even the most complex parts could be completed in one machining cycle.

The entire cycle, including operation of collet chuck and bar feed, is automatic and repeats until new bar stock is needed. Stock stop, drilling, reaming, tapping or O.D. threading is handled from the hex or octagon turret. The overhead slide is used to roll threads on some parts with forming and cut-off done by front and rear cross slide tools. On other parts, forming is handled by cross slide tools with cut-off from the overhead slide. A typical sequence is given in the photo caption.



Tooling for 2″ pipe reducing connector (Inset) made from hex bar stock. Tapered O.D. behind shoulder is rough-formed as machined part is cut-off from front cross slide. Rear cross slide finish forms tapered O.D. holding to .001″. Turret tools start-drill, radius and drill large and small bores, taper-ream and tap large bore. Overhead slide rolls thread behind shoulder. Stock advances to turret stop and cycle repeats. Time . . . 2.5 minutes f.t.f.

AR offers complete automatic cycle on bar work . . . cuts time 60%. . . combines operations. . . saves extra handling . . . improves accuracy. Operator can handle two machines.

For information on AR Turret Lathes, circle No. 758.

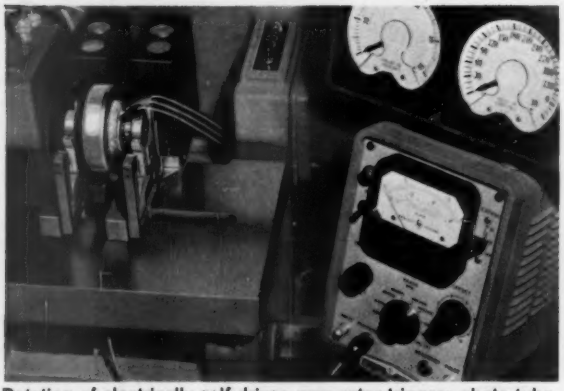
SPEED UP AND SIMPLIFY SMALL PARTS BALANCING

...New High Speed Balancer saves time, improves accuracy at low cost...

Producing small, high-speed parts or assemblies? You can now measure and correct for unbalance in parts weighing from ½ to 8 oz., or from 8 oz. to 10 lbs., rotating at any speed between 2,000 and 12,000 RPM.

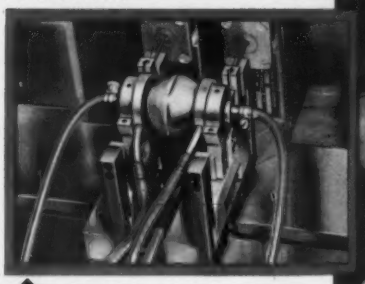
The HS-2 Balancer shown, is used for two-plane balancing of electrically self-driven gyro rotors and air-driven gimbal and gyro assemblies. It cut previous time in half and gave three times greater accuracy. Support fixtures permit quick changeover for additional time savings.

Except for method of drive, both workpieces are handled in the same manner. During each revolution, an abrupt change from dark to light finish on the work O.D. triggers a photo tube. This permits accurate speed indication on a tachometer and close regulation at 6,500 RPM for maximum accuracy. It also offers an exact reference point for locating angle of unbalance. After acceleration, angle and amount of unbalance is read in both planes in only 30 seconds. Meters eliminate all operator "guessing".



Rotation of electrically self-driven gyro rotor triggers photo tube under part to show speed on tachometer (lower right), and operate angle meter (top right).

Correction drilling of gyro rotor uses dial indicator to match depth on amount meter.



Air-driven gimbal and gyro assembly. Balancing sequence, including correction and inspection, takes less than 15 minutes.

A separate correction drilling unit is used to meet the .000020 oz. inch tolerance. To correct in each plane, work is placed in a fixture and indexed until the indicated angle is under the drill. The operator refers to a dial indicator as he drills to the depth shown on the amount meter. One correction pass in each plane takes less than 4 minutes. Additional passes may be necessary if unbalance is excessive or if material is not homogeneous. Work returned to balancer for final inspection.

HS production rates depend on part—range from 1 minute on fans and wheels to 4 minutes on armatures. Includes time to accelerate, locate, measure, stop, correct, inspect.

For information on HS Balancers, circle No. 759.

LOW-COST METHOD FINISHES MULTIPLE SURFACES

Completes one to six diameters during fast automatic cycle...

If you grind bearing and seal diameters on shafts or spindles, the savings offered by Superfinish will surprise you. The finishing of tractor transmission input shafts points up some of the chief advantages.

LOW COST . . . Here, a Model 51 General Purpose Superfinisher, using inexpensive abrasive sticks, handles a variety of parts. Machine and tool cost is only a fraction of what would be required if any other method were used to meet the close tolerance, fine finish requirements of the manufacturer.

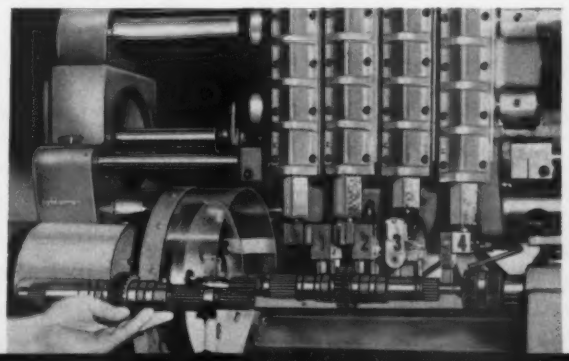
VERSATILITY . . . Extra quills can be added to complete several diameters simultaneously, with no increase in cycle time. Four quills are used on the part shown. Two off-set holders carry two stones each—the others carry one stone—so that six diameters are completed at the same time. These are reduced from 40 to 8 micro inches rms in only 50 seconds, f.t.f. Any other method would require more expensive tooling and/or several operations to do the same amount of work.

IMPROVED METALLURGY AND GEOMETRY . . . These parts are SAE 8630 steel. Specified hardness of 60-63 Rc must be maintained for reliable operation. They are rough ground to size and a 40 micro inch rms finish. Grinding heat anneals a microscopic layer on the surface. Superfinish removes this layer and exposes the true base metal. No heat is generated so hardness is unchanged. Because Superfinish is an area-contact process, roundness is improved and longer-pitch waviness is corrected. Peaks that break down and cause premature wear are removed, leaving plateaus for greater bearing area and valleys to retain lubricant.

Superfinish costs less... handles multiple surfaces with no increase in cycle time. Improves metallurgy and part geometry for greater product reliability.

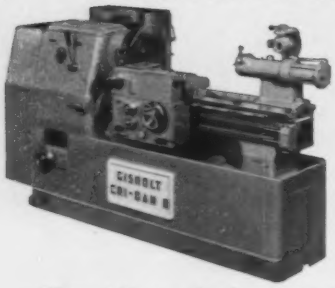
For information on Superfinish, circle No. 760.

Tractor transmission input shaft (SAE 8630 steel . . . 60-63 Rc) held between centers, driven from spline. Off-set holders 1 and 2 carry two stones each . . . finish four diameters. Holder 3 completes 1¾" long diameter. Off-set holder 4 handles one diameter. Six stones work together reducing 6 surfaces from 40 to 8 micro inches rms. Production . . . 48 parts per hour.



HOW TO BOOST PROFITS ON THREADING OPERATIONS

CRI-DAN Technique offers savings of 30% to 80% over conventional methods



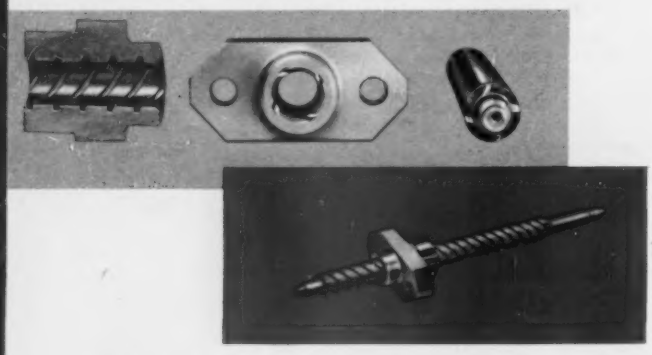
The photos on this page illustrate some of the threading operations you can do on a Gisholt Cri-Dan B Automatic Threading Lathe. Note the wide variety of work, the different threads and materials, and the fast threading times.

These jobs are simple on the Cri-Dan B—yet, each presented problems that could only be solved at high cost in equipment, tooling and time, using any other method. They prove *you* can use inexpensive, single-point carbide tools to produce simple or complex *quality* threads . . . *automatically*.

With Cri-Dan you'll have fast 15-minute setup, low tool cost, and versatility that permits combining precision threading with tracing, turning, boring or facing cuts in one automatic cycle. This means higher profits on small lots as well as long production runs.

Compare these threading times with your own, on similar work. How much could *you* save—with a Cri-Dan B?

For information on Cri-Dan B, circle No. 761.



AIRCRAFT RUDDER PEDAL ADJUSTING SCREW (SAE 4130-25-30Rc) AND NUT (Aluminum Bronze) for Lockheed Model C-130 Airplane

OPERATION

Screw: Generate ½"–10 4-start Acme Thread with 1" lead .060" deep for length of 5¾".

Nut: Generate matching 4-start internal thread.

TIME

Screw: 25 minutes f.t.f.
Nut: 15 minutes f.t.f.

SAVINGS

Screw: 65 minutes per part (previously milled).

Nut: Difference between cost of single point carbide tool and $490.00 tap for this job.

CUSTOMER

Orlando Machine Co., New Smyrna Beach, Florida.

SPOOL VALVE (440C Stainless)

OPERATION

Generate tapered 20 TPI NF Class 3 thread in .4675" bore right up to internal face.

TIME

30 seconds to thread—production 35 parts per hour.

SAVINGS

5.03 minutes per part—467% compared to tapping. Rejects eliminated (were as high as 20%), longer tool life (to 75 parts per grind).

CUSTOMER

Acme Industrial Co., Chicago, Illinois.

BEARING ADJUSTMENT NUT (cast iron)

OPERATION

Turn, chamfer front O.D., generate 12 TPI, .054" deep thread on 6½" O.D., face and chamfer rear O.D.

TIME

1.8 minutes f.t.f.

SAVINGS

60% on machining and threading time; replaced two machines; improved quality.

CUSTOMER

Mack Trucks, Inc., Plainfield, New Jersey.

ZOOM OPERATING SLEEVE (Aluminum); FRONT CELL LENS (Aluminum) for 8 mm. ZOOMATIC MOVIE CAMERA

OPERATION

Sleeve: Bore, generate 2-start, .0625-pitch, .125" lead, Class 4 16NS thread in 1.610" center section of bore.

Lens: Turn rear pilot diameter, generate mating threads on 1.610" leading diameter.

TIME

Sleeve: 20 seconds f.t.f.
Lens: 20 seconds f.t.f.

SAVINGS

50% time reduction — improved quality.

CUSTOMER

Bell and Howell, Chicago, Illinois.

GISHOLT

MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

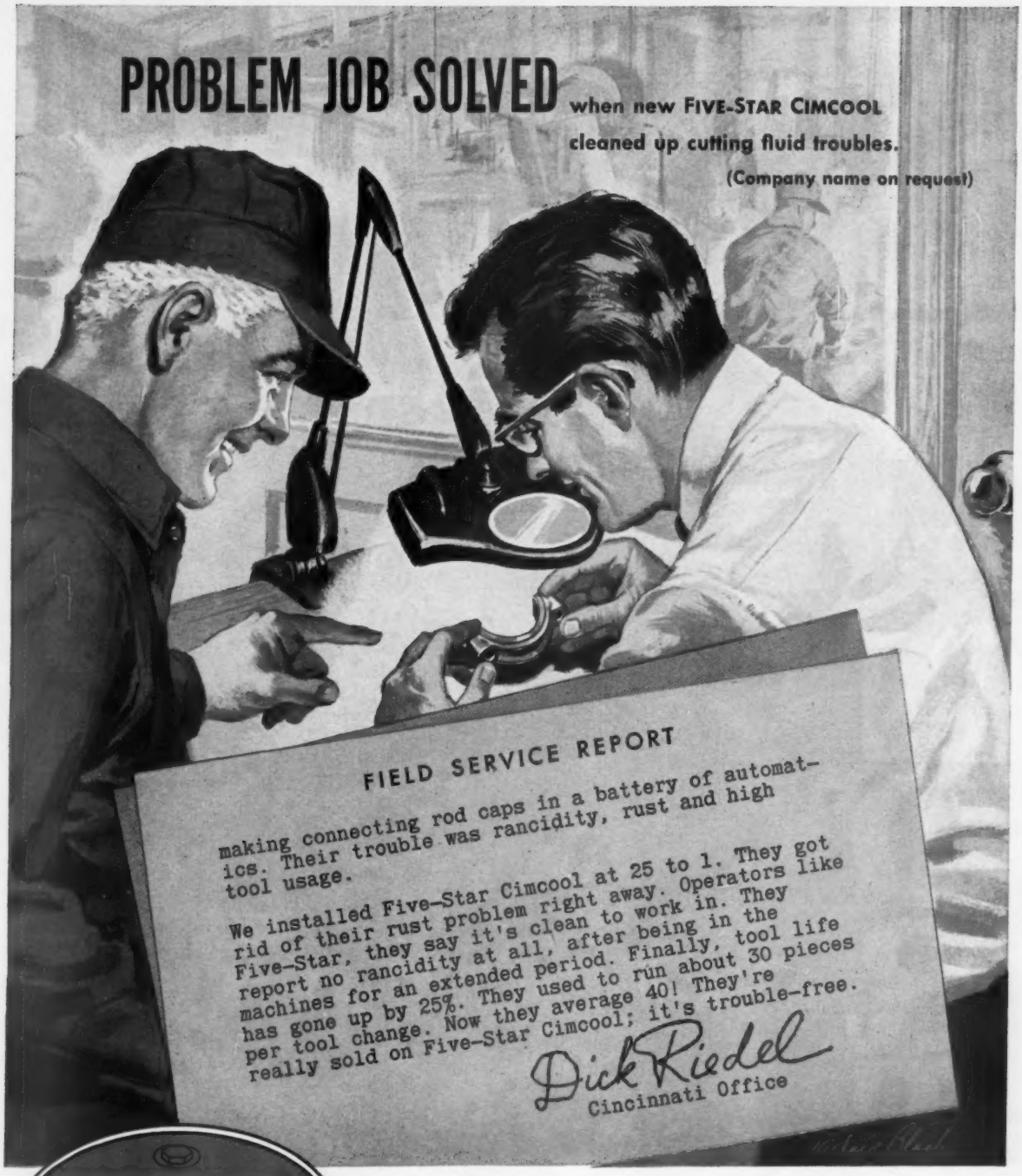
The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

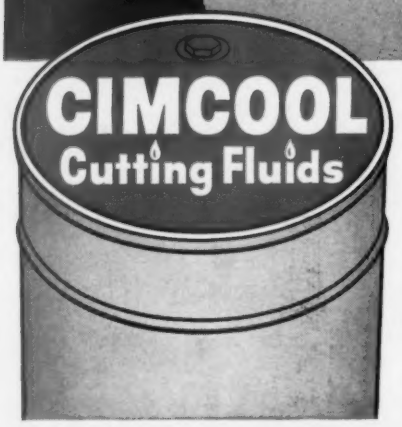
No. 7-861
803

Turret Lathes • Automatic Lathes • Balancers • Superfinishers

Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

Printed in U.S.A.


PROBLEM JOB SOLVED when new FIVE-STAR CIMCOOL cleaned up cutting fluid troubles.
(Company name on request)
FIELD SERVICE REPORT
making connecting rod caps in a battery of automatics. Their trouble was rancidity, rust and high tool usage.
We installed Five-Star Cimcool at 25 to 1. They got rid of their rust problem right away. Operators like Five-Star, they say it's clean to work in. They report no rancidity at all, after being in the machines for an extended period. Finally, tool life has gone up by 25%. They used to run about 30 pieces per tool change. Now they average 40! They're really sold on Five-Star Cimcool; it's trouble-free.
Dick Riedel
Cincinnati Office



FOR 100% OF ALL METAL CUTTING JOBS

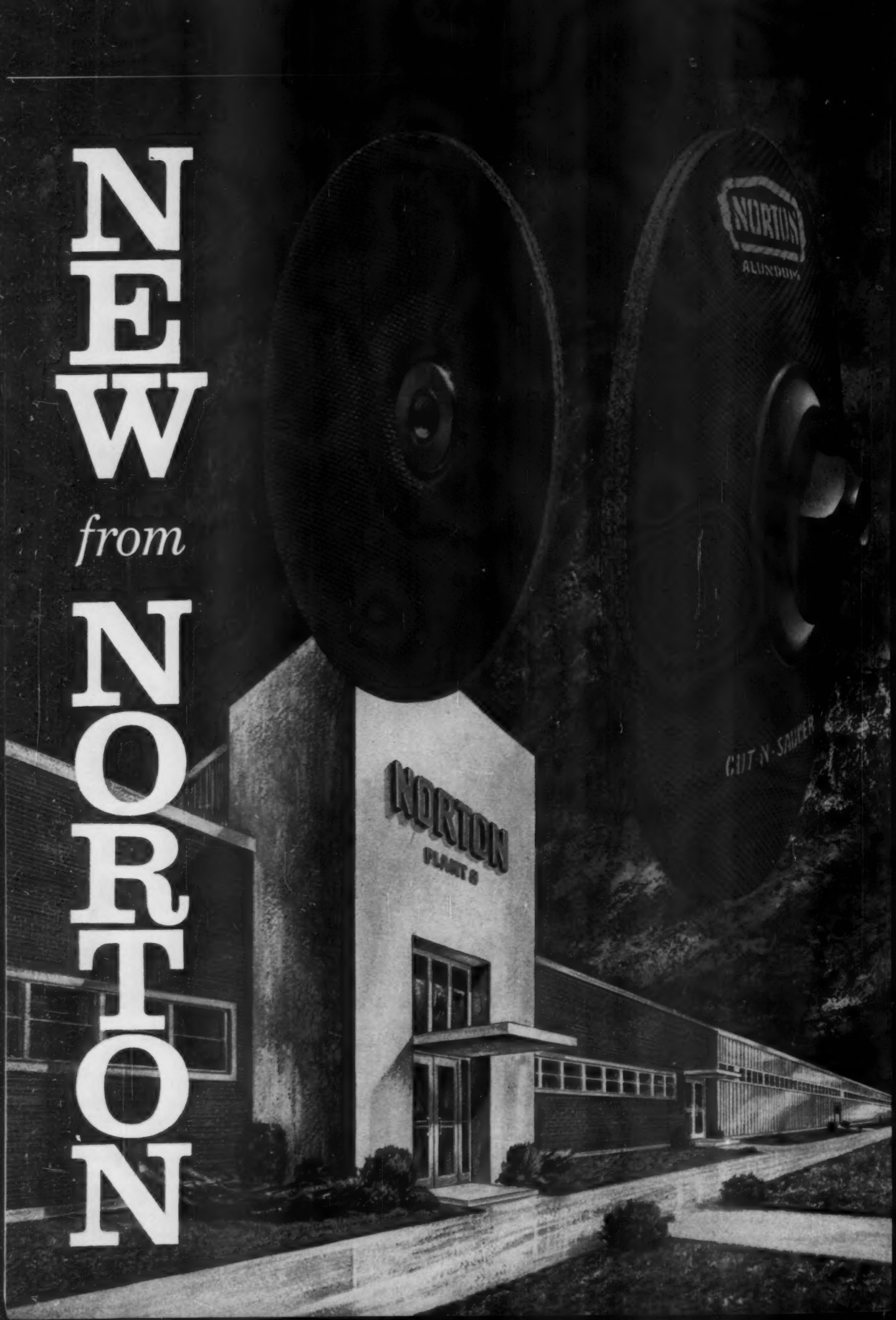
Production-Proved products of The Cincinnati Milling Machine Co.

FIVE-STAR CIMCOOL—Newest in the industry-proven line of CIMCOOL° Cutting Fluids.
CIMPERIAL° — Heavy duty replacement for cutting oils in those low-speed tough jobs.
CIMPLUS — The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS) — For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Marks Reg. U.S. Pat. Off.

NEW *from* NORTON



CUT-N-SAUCER wheels with DIS-CARD mounts

A new combination from Norton's newest plant

For easier, faster weld-grinding, light snagging and many other portable grinding jobs, Norton now offers you:

The only reinforced wheels that combine a saucer shape with a disposable mount.

These are the new BSA Type Cut-N-Saucer wheels with Dis-Card mounts . . . available in 7″ and 9″ diameters. They are produced in the big new Norton Plant 8, built specifically to improve the manufacture and performance of resinoid wheels.

Reinforced with layers of fibre glass, BSA Cut-N-Saucer wheels gain added advantages from the new shape. Compared with straight wheels, BSA wheels on the job can be held at angles much closer to the horizontal. Results are easier control and reduced operator fatigue.

The Dis-Card mount is equally new and vital. Unlike ordinary mounts it is no separate attachment. It is permanently secured — designed to be bought and thrown away with every wheel. This means you can change wheels in seconds — completely eliminating "lock washer" action and the usual mounting routine that can take up to half an hour. So every Cut-N-Saucer wheel you buy is already mounted — and *stays* mounted, throughout wheel life.

Yet you pay no more for a Norton Cut-N-Saucer than for a conventional reinforced wheel!

Cash in on this first opportunity ever offered to you to get advantages never before combined in a single, standard priced, portable grinding wheel. For further facts on the new BSA wheels — or on straight wheels also with Dis-Card mounts — see your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES

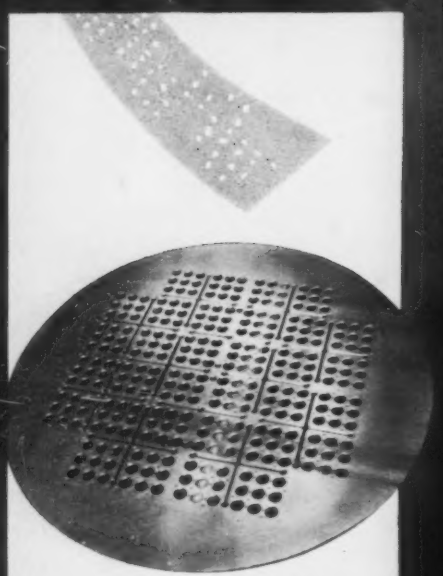
W-2017

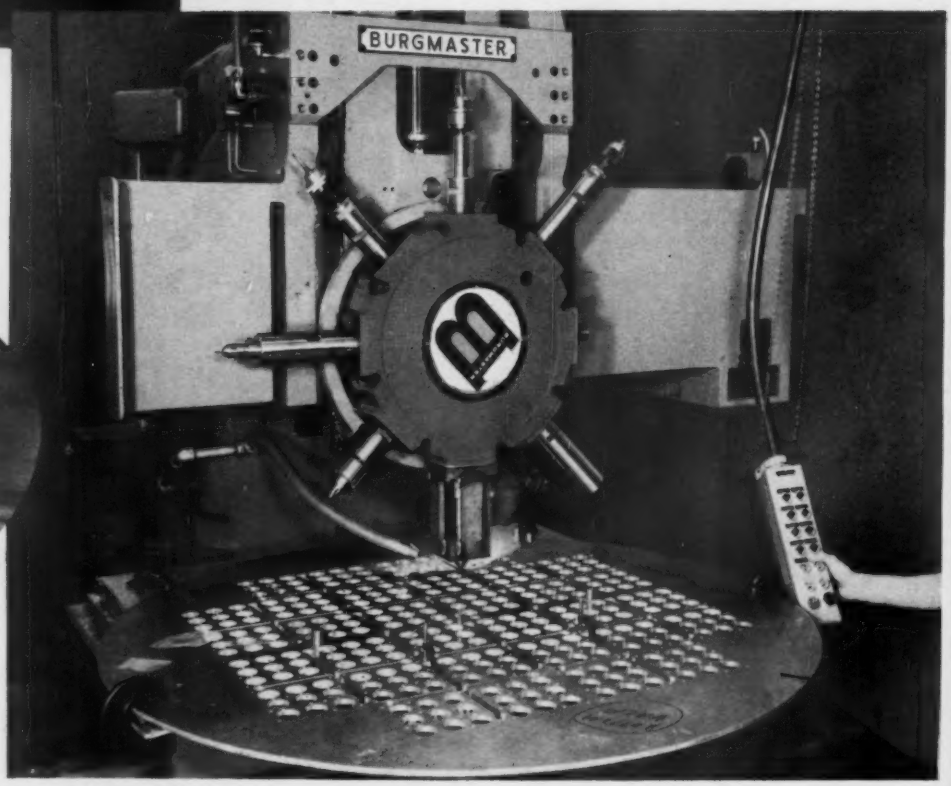
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

GENERAL ELECTRIC USES Burgmaster TAPE

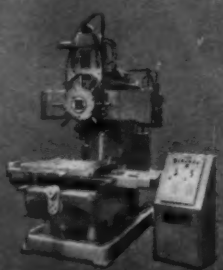
- **Production Speeded from 8 Weeks to 9 Days**
- **Saves 60 Hours of Lead Time**
- **$800.00 Fixture Eliminated**



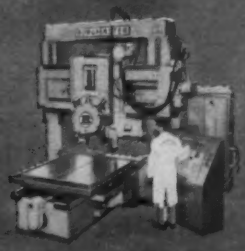


Burgmaster Model 3BHT
8-spindle, 1½" capacity in steel. Table travel 20x30, 30x45.

Model 25AHT
6-spindle, 1¼" capacity in steel. Table travel 15x26, 20x30, 30x45.



Model 2BHT
6 spindle, ¾" capacity in steel. Table travel 10x18, 15x26, 20x30



Model 3BHT-B Double Housing Planer Type
8-spindle, 1½" capacity in steel. Table travel 48x60.

CIRCLE 205 READER SERVICE CARD

CONTROLLED TURRET DRILLS

TO PROGRAM 2,098 OPERATIONS EACH PART

(General Electric Company, Atomic Power Equipment Dept., San Jose, Calif.)

● *Tape-Controlled milling operations* are now added to the versatility of the Burgmaster Model 3BHT, 8-spindle tape-controlled Turret Drills. At General Electric's San Jose facility, 10 slots .176" wide and 3½" long, and 24 slots ⅜" wide and 10" long are milled in a 6061-TC aluminum nuclear reactor grid plate ⅜" thick. These milling cuts are rough and finish, both sides, and are all programmed in tape. 1962 additional center drill, drill, bore, ream and tap operations necessary to complete each unit are also programmed in tape and performed by the Burgmaster Model 3BHT with push-button control. All holes are held to .004" true position over entire area. In this operation, production has been speeded from 8 weeks to 9 days, 60 hours of lead time have been saved and an $800.00 fixture eliminated.

JOB FACTS

Company: General Electric, Atomic Power Equipment Department, San Jose, California.

Machine: Burgmaster Model 3BHT—"GENERAL ELECTRIC MARK II" Tape-Controlled Turret Milling, Drilling, Tapping and Boring Machine.

Part: Nuclear Reactor Grid Plate, ⅜" x 55½" diameter.

Special Attachments: Milling, Reciprocating Drilling, 3-Dimensional.

Lot Size: 2

Tolerance: .004" of True Position Over Entire Area.

Holding: 2 Pins on Sub Plate, Simple Clamps.

Machine Operations: Total 2,098 Machine Operations.
288 holes—center drill, drill, bore and ream (4)
384 holes—drill (1)
128 holes—drill and tap (2)
60 holes—drill and bore (2)
50 holes—drill (1)
10 slots—mill, rough and finish both sides (4)
24 slots—mill, rough and finish both sides (4)

Former Method: Individual Milling and Drilling Machines with Drill Fixtures.

Present Method: All operations programmed in tape for Burgmaster Model 3BHT.

Savings: 31 Days, 60 hours lead time, $800.00 fixture.

Other Advantages: Greater Accuracy, Less Cost. No Scrap Loss, Eliminates Operator Fatigue.

World's Largest Builder of Turret Drilling Machines

"0" Manual Power Index ⅛" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

25AH Automatic Tape Controlled 1¼" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1¼" Capacity

Send for Literature

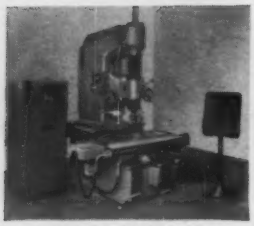
Write for bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

Burgmaster CORPORATION

15001 S. Figueroa Street • Gardena, California • FAculty 1-3510 DAvis 9-4158

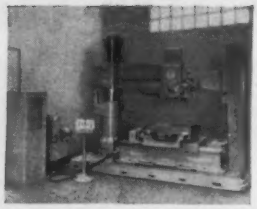
BURGMASTER DIRECT SALES OFFICES: Ridgewood, New Jersey, 86 North Maple Avenue., GIlbert 4-3002 • Chicago 5, Illinois, 4908 Lincoln Ave., LOng Beach 1-1178 • Cleveland 7, Ohio, 14706 Detroit Ave., ACademy 6-7030 • Detroit 37, Michigan, 13730 W. Eight Mile Road, Lincoln 8-4333 • Northern California, Castro Valley, JEfferson 7-1650 • Kearney & Trecker, C.V.A. Ltd., Sole Agents for Great Britain, British Commonwealth and Western Europe.

CIRCLE 286 READER SERVICE CARD



W. B. Knight Jig Borers

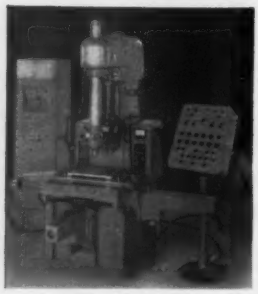
Wiedematic Turret Punch Presses



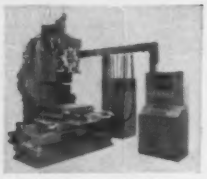
American Tool Works Co. Boring & Drilling Machines

When only the finest will do...

De Vlieg Jigmills

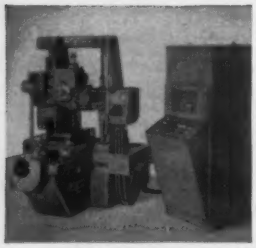


Moore Jig Borers

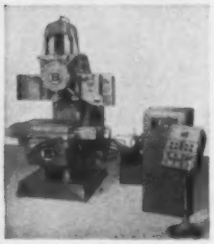


Avey Turret Drills

Bullard Spacer Tables (Retrofit Kits)



SIP Jig Borers



Burgmaster Turret Drills

specify

SPERRY NUMERICAL CONTROL

FOR **PRECISION • RELIABILITY • PRODUCTIVITY**

SIMPLICITY—There are fewer components in a Sperry Control, thanks to the pneumatic block reader that does away with complex memories or shift registers. Fewer components mean higher reliability, and easier maintenance.

ACCURACY—Independent linear measuring scales provide extremely high accuracy unaffected by age or wear. The initial accuracy built into the machine remains constant throughout its life.

RELIABILITY—Sperry Controls contain almost 33% less components than conventional designs and by this fact alone are considerably more reliable. Machines equipped with Sperry Controls do not use vulnerable ball bearing leadscrews, thus simplifying machine maintenance too.

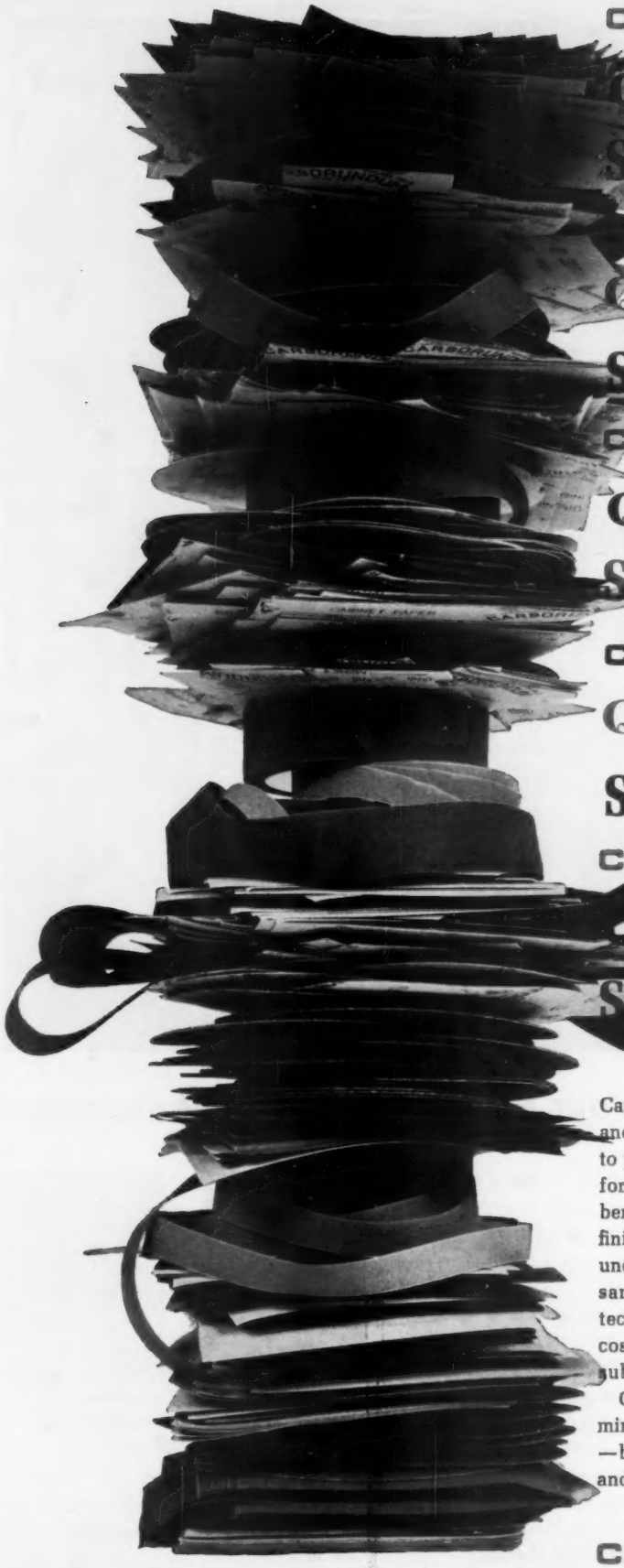
SPEED — The Sperry block reader can read one two coordinate position and auxiliary commands in 1/10 of a second. This fact combined with the high performance of hydraulic actuators, provides exceptionally high positioning speeds. Traverse speeds of 700"-1000" per minute are being achieved on certain machines.

Further information can be had from machine tool builders and dealers — or write us direct for illustrated brochure. A powerful and dramatic 15-minute sound movie on the Sperry Numerical Control is also available — ask to see it.

SPERRY

SPERRY GYROSCOPE COMPANY OF CANADA, LTD.
P.O. Box 710 • Montreal 3, Que.

922



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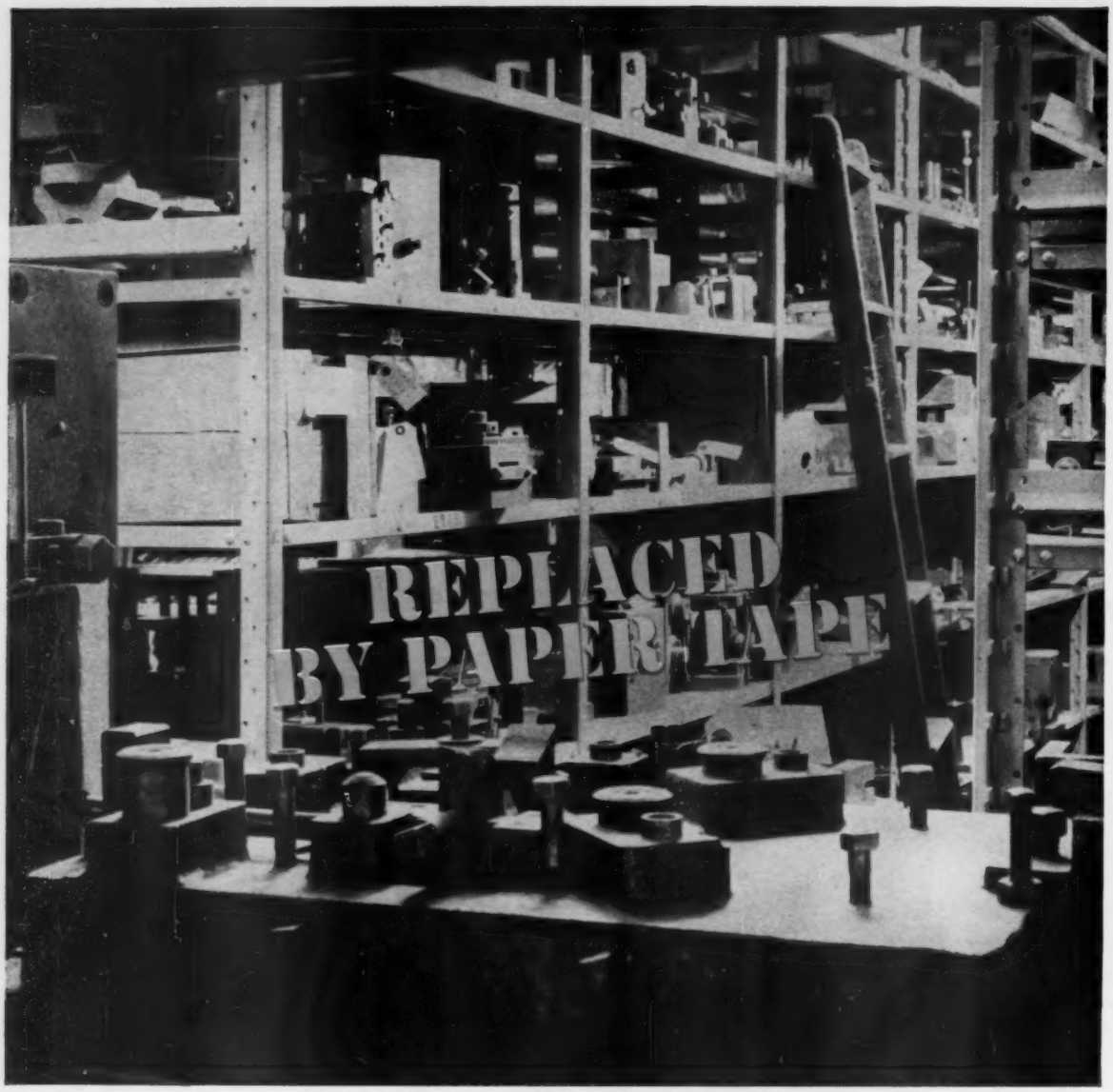
Carborundum® sandpaper sheets, belts, discs and Economy® Rolls are deliberately designed to pay real dividends in small-job sanding—for all hand applications, and portable or bench machine work. They cut faster and finish more uniformly, because they are made under the same rigid controls, and from the same fine abrasive materials, as the most technical coated abrasive products. Their cost is small—but the savings they bring can substantially reduce your overall expense.

Give your Carborundum distributor a few minutes to show how Carborundum quality—backed by his own abrasive knowledge and service—can help you.

CARBORUNDUM



Drilling? Boring? Seize Your Numerical Control Advantage

Buy no new jigs and fixtures. Convert storeroom space for useful work. Cut down heavy inventory investment. Tape control is taking over.

More than 500 hours and $5,300 went into making that obsolete drill jig in the foreground. It was used one year. You could make a tape to do the same work for $50, store it in an envelope, revise it for model changes in 20 minutes.

For low volume drilling, milling, turning, and a host of other metal-working operations, there just isn't any other way to beat the cost-cutting ability of numerical control.

Before making new drilling and boring fixtures, write for the bulletin "FPB" describing Fosdick's numerically controlled precision boring and jig grinding machines. Write for bulletin "FTD" describing the 32-spindle Fosmatic Turret Drill. It's time to "get a proposal from Fosdick!"

Write for bulletin "FPB"

Write for bulletin "FTD"

FOSDICK

The Fosdick Machine Tool Company
Cincinnati 23, Ohio

CIRCLE 289 READER SERVICE CARD

CIRCLE 290 READER SERVICE CARD ►

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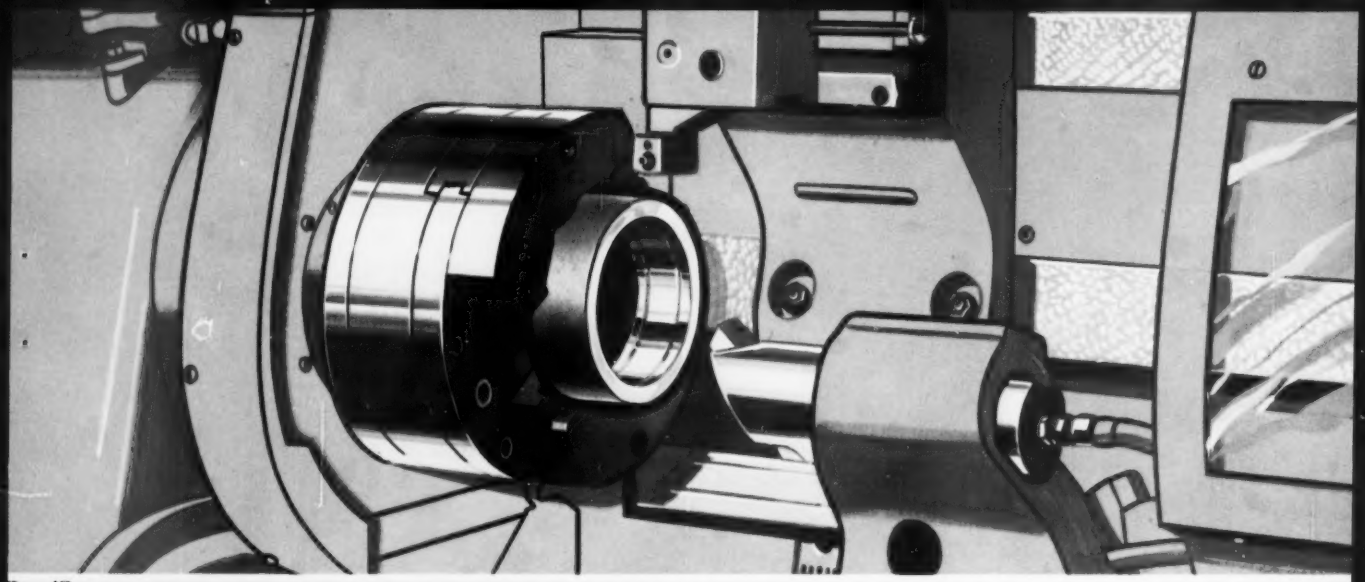
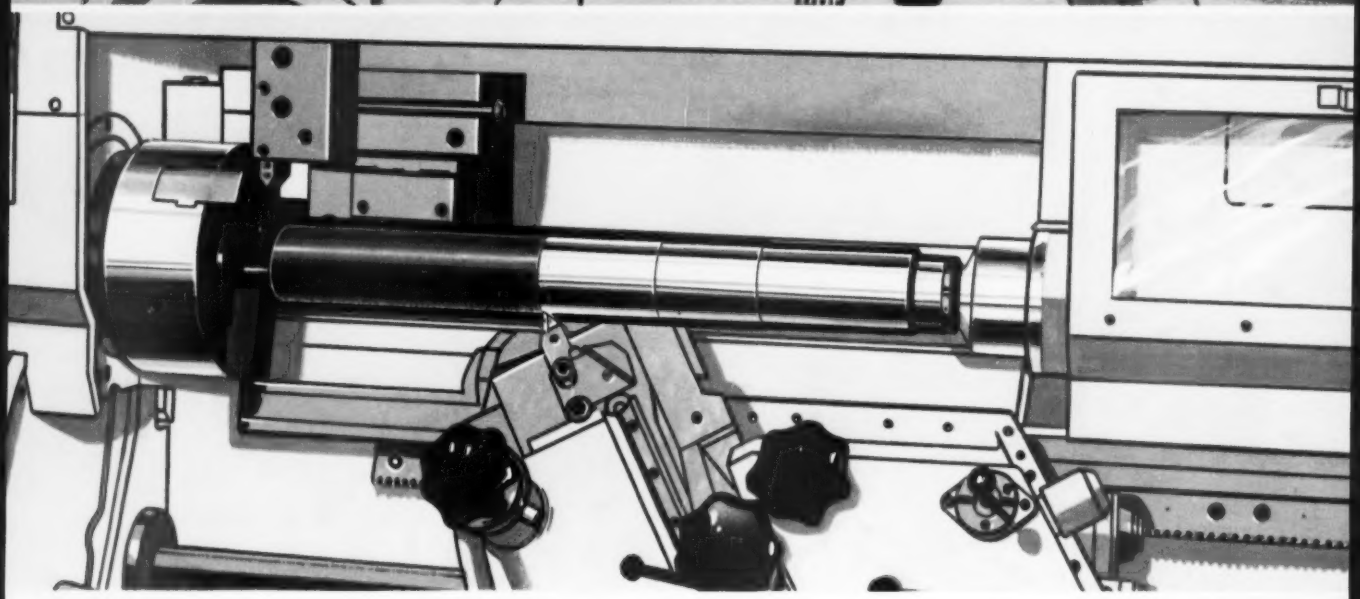




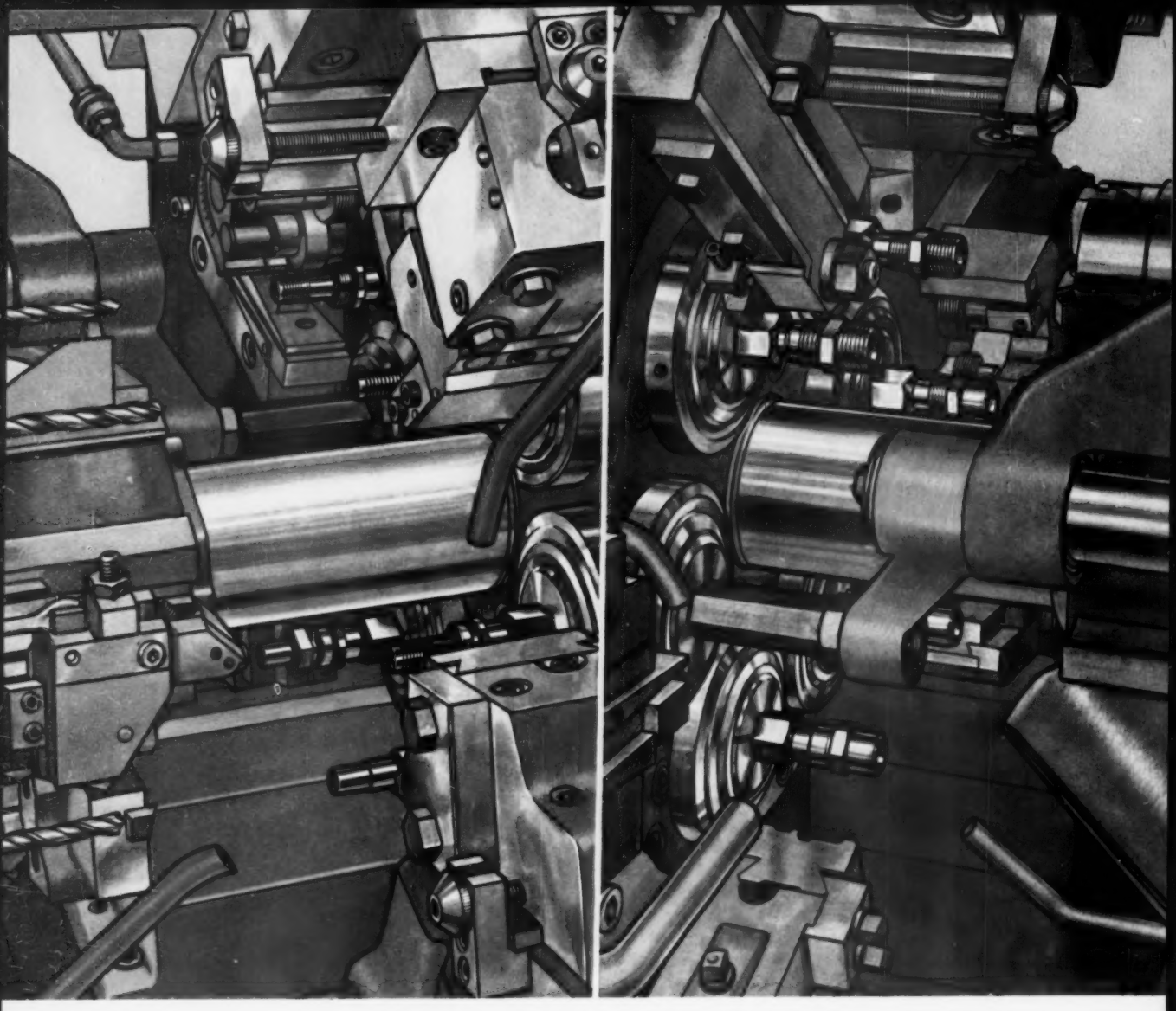
Years-ahead flexibility
in New Britain's +GF+ *Copying Lathes*

One of the best ways of making sure you're on the right track when you buy a new machine is knowing what you want the equipment to do and then being sure the equipment you buy can do it. This sounds pretty basic, but it's difficult to forecast just what you are going to require of a machine through all the years you will use it. In this department, the New Britain +GF+ Copying Lathe has a lot of peace-of-mind insurance built right into it. For instance, the basic design of the machine suits it for a wide variety of work. The single-tool copy-turning principle is equally well suited for both chucked *and* between-centers work on internal and external surfaces.

Because the tool path is controlled by an easy-to-install template (or a prototype) set-up and change-over are accomplished in a few minutes. The cutting tool can be replaced in a matter of seconds. Back facing is accomplished as part of the machining cycle by means of a top-mounted attachment.

The New Britain +GF+ is truly a machine that can pull more than its own weight in any metal-working shop. On top of that, it can adapt quickly and easily to the widest possible number of new requirements that may be placed on it in the years to come. A new catalog describes the complete line in detail.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Stainless, 225 per hour— brass, 1500 per hour

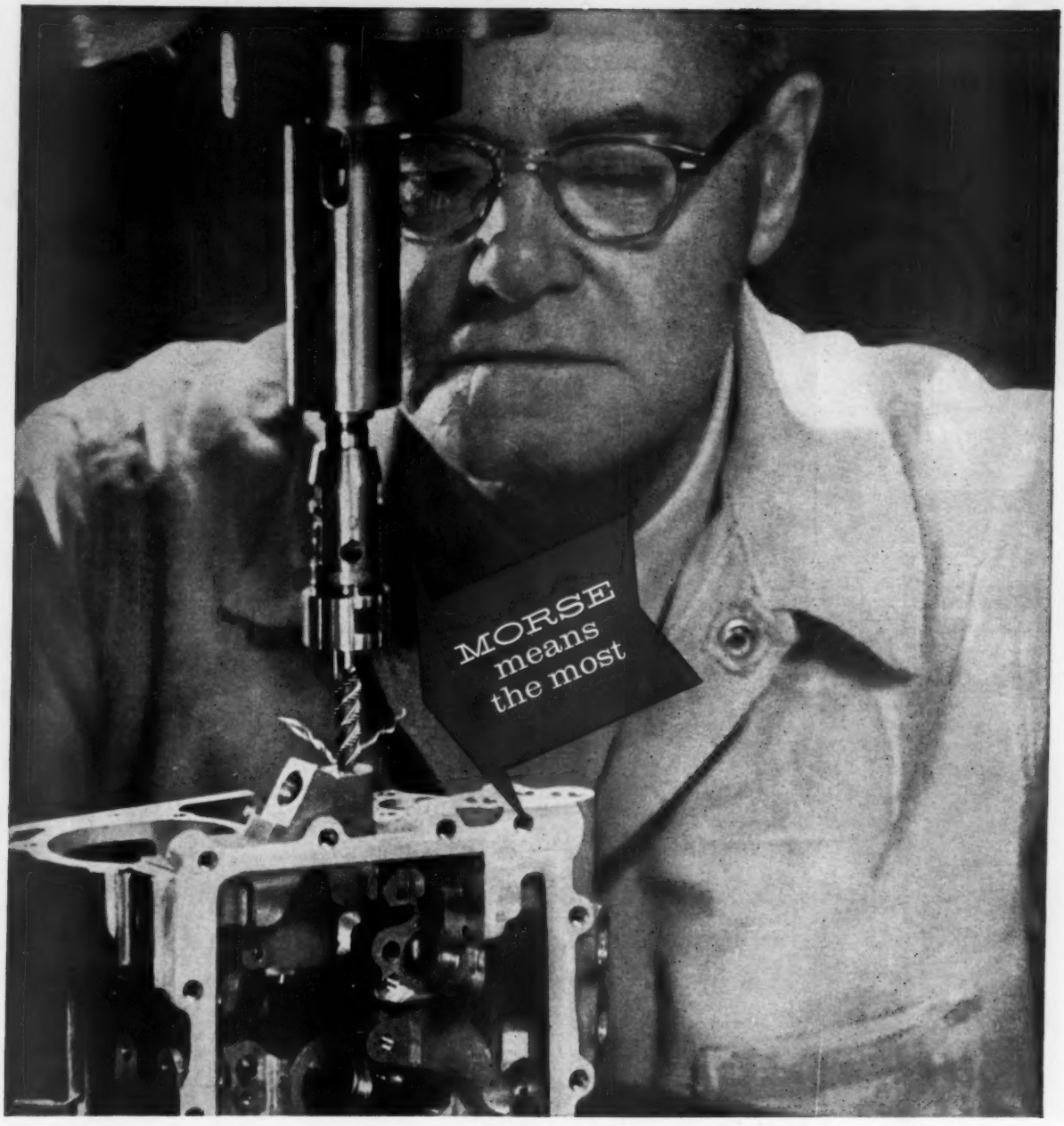
Speed is only part of the story on New Britain's completely new line of four-, six-, and eight-spindle bar machines. Guaranteed accuracy, production run after production run, year in, year out, helps round out the story. If you haven't seen any of the new series in action—six models in all—you owe it to yourself and the profitable productivity of your plant to arrange for a demonstration. All of the exclusive New Britain features you are probably familiar with have been retained and improved. New features unavailable on any other machines have been added. The result—the finest high speed bar turning units on the market. Your New Britain representative is the man to see. He can show you applications, parts production case histories, show you to fractions of seconds and pennies why new New Britain bar machines are an investment in greater profits with every piece they produce.

Model	Spindles	Cross Slides	Spindle Speeds	Spindle Capacity	H.P.
450	4	4	41-621	5⅛"	30-50
52	6	6	271-4250	1¼"	15-25
62	6	6	177-2519	1⅝"	15-30
62	6	6	177-2519	2¼"	20-30
635	6	6	63-630	3½"	30-50
826	8	6	98-1481	2⅝"	30-50

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division • New Britain, Connecticut

with men who know cutting tools... it's MORSE everytime



TRY MORSE... BUY MORSE
SEE YOUR NEARBY MORSE DISTRIBUTOR

MORSE

MORSE TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASSACHUSETTS

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◄ CIRCLE 291 READER SERVICE CARD

CIRCLE 292 READER SERVICE CARD

CAPABILITY

Total machine *capability* is what counts in the toolroom. That's why the NEW 1307T is so popular. Its capability can be measured in profit, production, versatility, and convenience . . . as well as in accuracy, service, capacity, and ease of operation. Stepless, electronic speed changing improves efficiency and finish. Larger and a greater variety of parts can be machined. The bed is longer, the swing is greater, and the compound rest has more travel. Electric dynamic spindle braking, extra-large spindle bore, feed rate of .0002 ipr, and quick-change gear box controls all give the 1307T greatest TOTAL CAPABILITY in its class. Literature and prices on request.

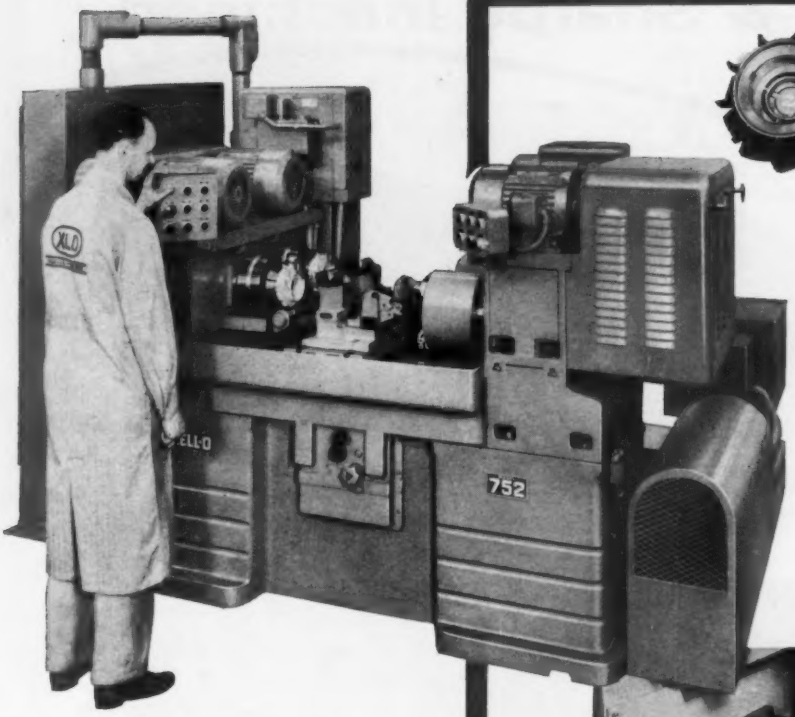
BARBER-COLMAN COMPANY

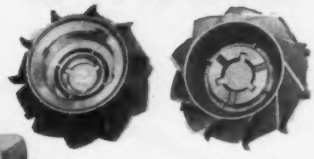
BARBER COLMAN

71 ROCK STREET, ROCKFORD, ILLINOIS

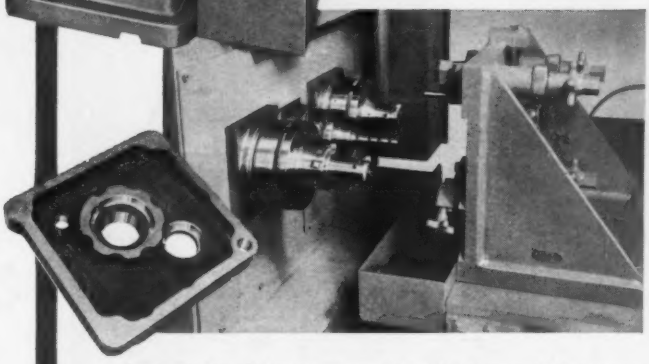
Let the work size, operations, finish or output change . . .

Standard Ex-Cell-Os will meet your needs!





Double-end Model 752 (shown at left) finish-machines both sides of this torque converter stator in one cycle at a rate of 140 per hour. Standard tooling, spindles, and other components permit fast change-over from this job's boring, turning, facing, grooving and chamfering operations to any required single or multiple functions.



Close center-distances are held on this transmission pump cover, one of three different parts finished on a single-end Model 751 Precision Bore. Cross slide indexes during each cycle, and a common spindle bores the dowel holes. One or more Heavy Duty or Ultra Precision Spindles can be used in place of the three Ex-Cell-O Square Body Spindles shown.

Modern Ex-Cell-Os represent over 30 years of specialization in Precision Boring Machines. Your Ex-Cell-O Representative has data on a wide variety of standard, special and building-block types to quickly provide optimum equipment utilization in your plant. Call him soon, or write direct for details.

61-16M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

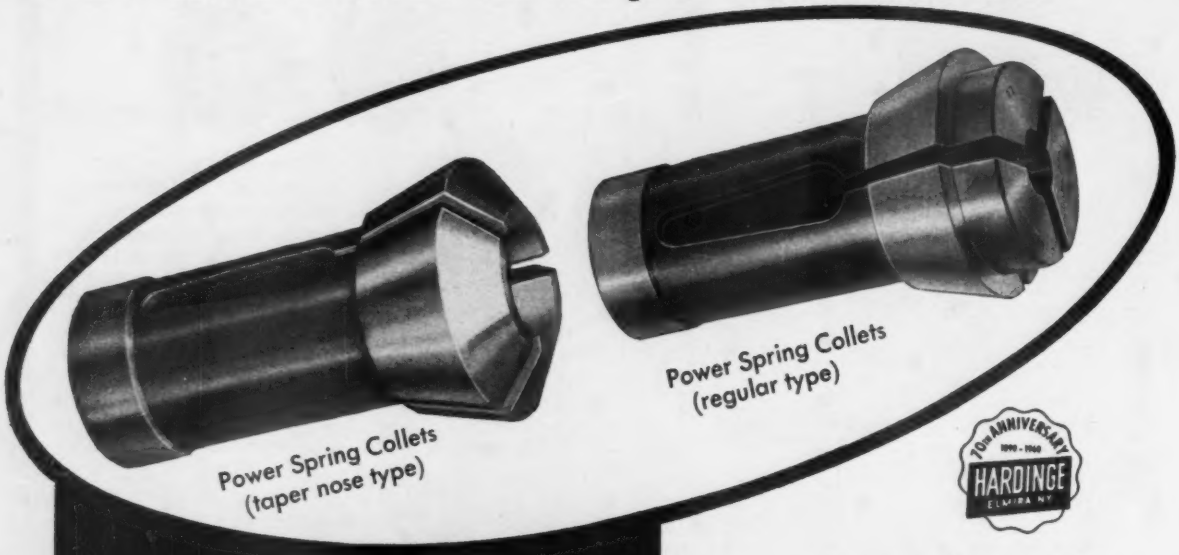
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

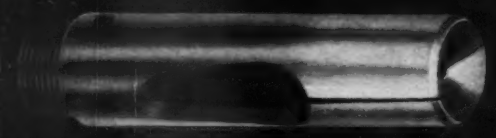
HARDINGE
ELMIRA, N.Y.

COLLETS and FEED FINGERS

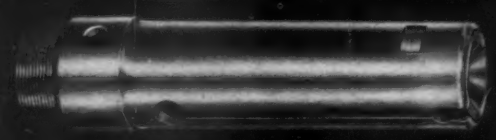
For Brown & Sharpe Machines



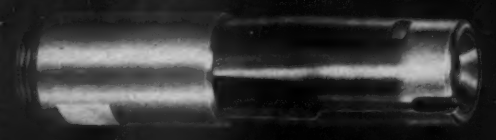
70th ANNIVERSARY 1890 - 1960 HARDINGE ELMIRA N.Y.



Feed Fingers (regular type)



Master Feed Fingers and Pads



Master Feed Fingers with Adjustable Tension for No. 00, 00G, 0 and 0G Machines.

To get maximum production efficiency from your Brown & Sharpe Machines — specify HARDINGE Collets and Feed Fingers.

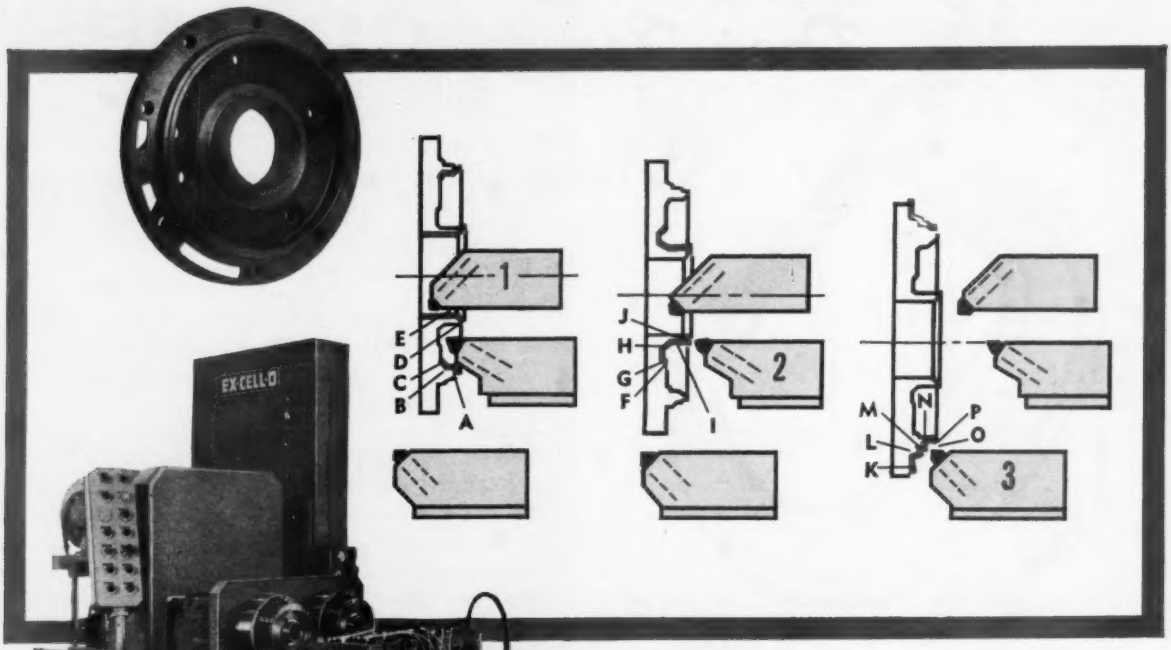
Specifically engineered, customer-shop tested and approved for Brown & Sharpe Machines, Hardinge Collets and Feed Fingers will reduce tooling costs and step up production.

Immediate Stock Delivery From:
Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Oakland, Minneapolis, St. Louis, Springfield, N. J., Rochester, N. Y., Portland, Seattle, Toronto.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Ex-Cell-O Model 312 generates 21 surfaces per part!



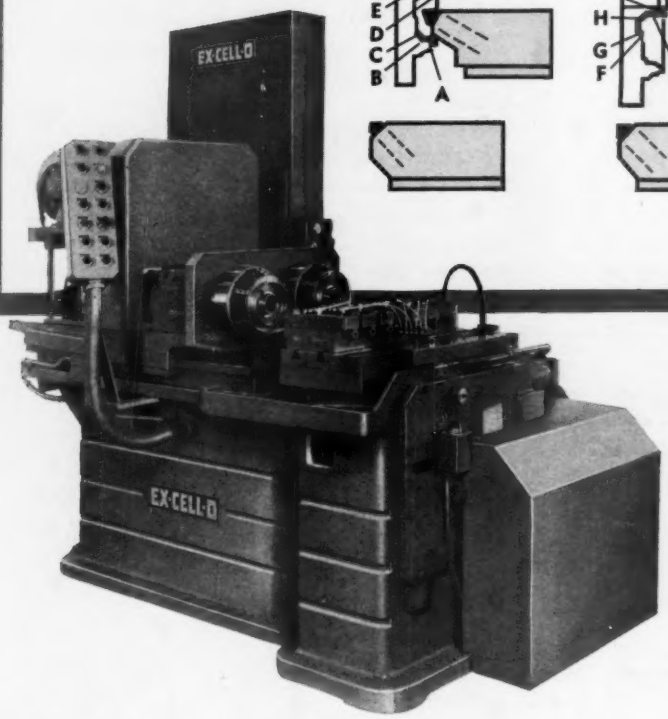


Diagram shows tools in quick-change magazines at the end of their strokes.

Tool No. 1 generates chamfer A, bores diameter B, generates radius C, traverses out, chamfers D and bores E.

Tool No. 2 generates surfaces F, G, H, I, and J with cam-controlled accuracy.

Tool No. 3 faces K, generates radius L, tapers M, turns N, chamfers O and generates radius P in cast-iron clutch assemblies.

Ex-Cell-O Cam-Operated Precision Boring Machines are designed especially for work requiring consistently precise boring, plunge-facing, grooving, chamfering and other O.D. and I.D. contours. Table and slide movements on hardened and ground ways are guaranteed by direct cam action—there are no levers, no complex linkages. For maximum accuracy, cams can be ground for you in our plant on numerically-controlled machines.

Two models, 308 and 312, rough, semifinish and finish a wide range of parts. Ask your Ex-Cell-O Representative for data, or write direct for details.

61-17M

EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing. Medium service, extra deep throat and spatter resisting types are equipped with new ARMSTRONG ball-joint swivel pad which will not come off. Pad is optional on tool makers clamps.

In case you do not know who handles the ARMSTRONG Line in your area, we will be glad to supply this information.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

Write for New Catalog 700

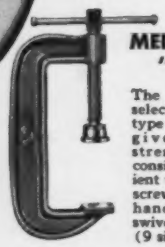
ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with ground seats; have sliding pin handles and ball-joint swivel pads. Bodies have smooth sand-blast finish.
(11 sizes to 12" opening)

HEAVY DUTY "C" CLAMPS

Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiplies thread friction against loosening. Alloy steel screws are hardened at point to prevent upsetting. Ground seat.
(8 sizes to 12" opening)



MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and ball-joint swivel pad. Ground seat.
(9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or with ball-joint swivel pad.
(Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS

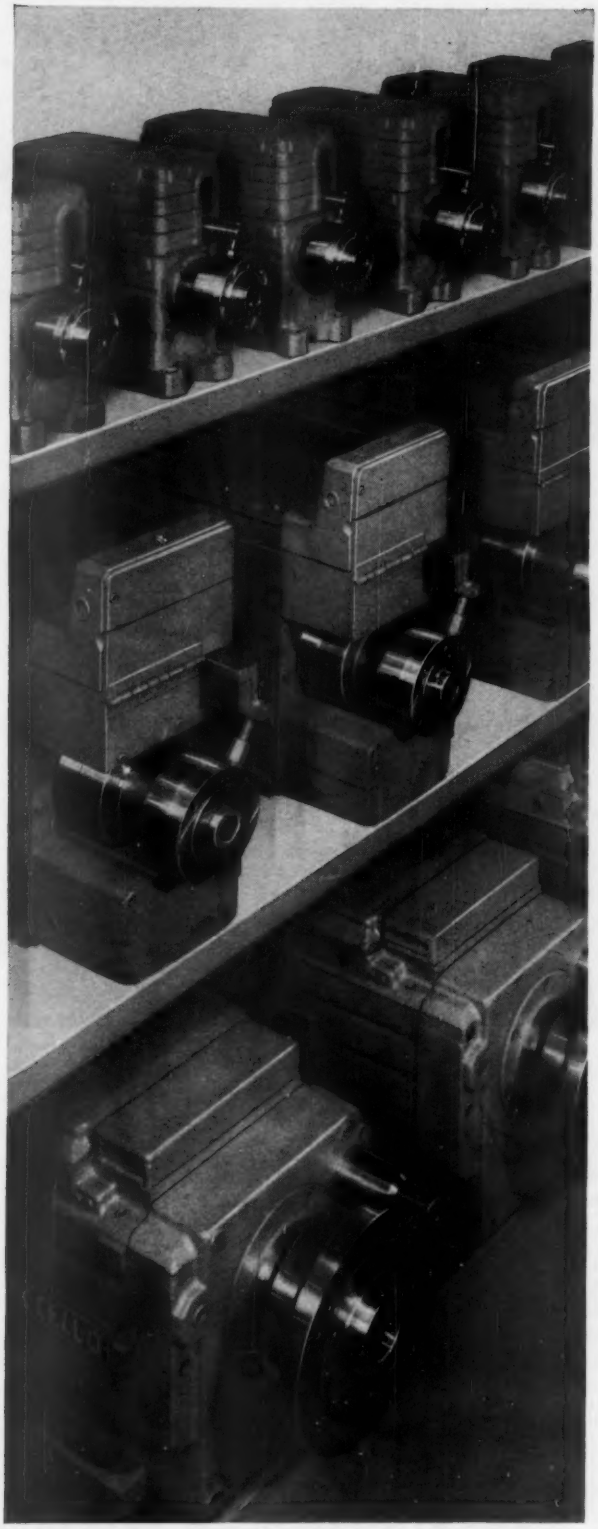
Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
(8 sizes Capacities to 12" opening)

MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
(Four sizes: Capacities to 4¼" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
(3 sizes: Capacities to 2½" opening).



NEED Power Units in a Hurry?

Ex-Cell-O gives you off-the-shelf delivery!

In stock for immediate delivery, Ex-Cell-O Hydraulic Power Units are available in four quill-type models offering a wide range of spindle speeds, horsepower, stroke and thrust.

Self-lubricating for low maintenance, and precision-built for long life, Ex-Cell-O Hydraulic Power Units, and our Canadian-built lead-screw type Tapping Unit, are designed for drilling, reaming, tapping, spotfacing and other single or multiple operations, and for heavy-duty boring and milling machine applications. Pre-set start, rapid approach and return, dwell, reverse and stop are fully automatic.

Your Ex-Cell-O Representative has complete specifications, or write direct for our catalog. The model you need is on the shelf now—ready for same-day shipment to your plant!

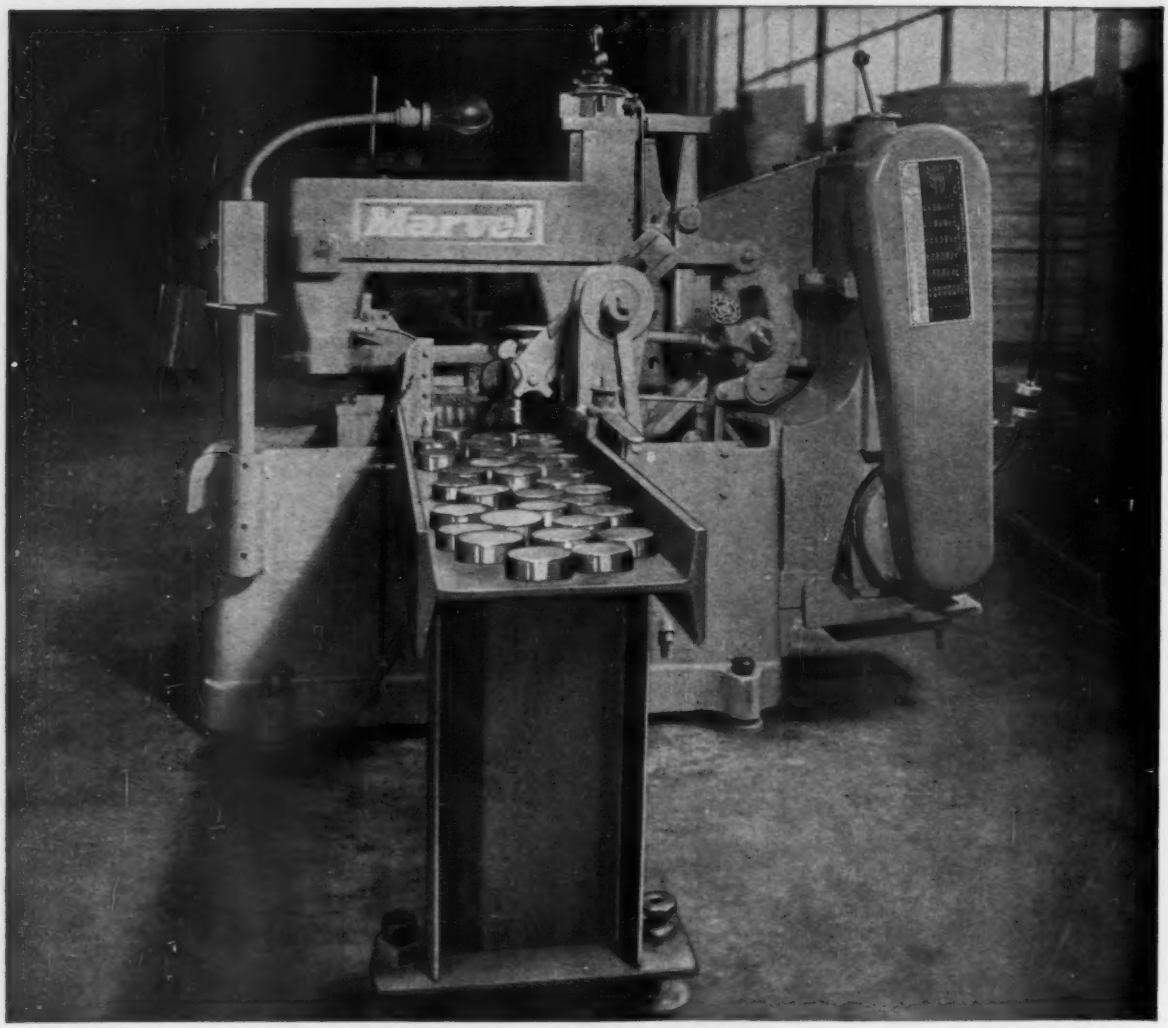
61-21MA

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



Payoff End of a Production Marvel

A cut-off saw's value is proven at the discharge end of the machine. How quickly the trough is filled with accurately cut-off pieces can mean the difference between profit and loss on many jobs.

The R. J. Sudrick Co., Des Plaines, Illinois, manufacturers of precision aircraft components had to cut-off 4600 blanks from 3¼" round, 303 Stainless Steel Bars.

They bought our MARVEL No. 6A4 High Speed Heavy Duty Automatic Bar Feed Hack Saw Machine; used MARVEL High-Speed-Edge Hack Saw Blades, and got the high production, accuracy and economy they desired.

PRODUCTION? Constant at 20 pieces per hour floor to floor

ACCURACY? Held well within the permissible tolerance of +.010 —.000

BLADE COST? Just 1½¢ per cut. Only twenty-three MARVEL blades were needed to make the 4600 cuts, and not a single blade failure due to blade breakage. MARVEL High-Speed-Edge Blades are unbreakable.

The point is this: MARVEL Metal Cutting Hack Saws equipped with MARVEL High-Speed-Edge Hack Saw Blades are an unbeatable combination for economical, accurate and safe cutting-off.

If your hack saws are not producing the economy you need to meet today's competition, try MARVEL High-Speed-Edge Blades. They will give you the competitive edge every time. Write for Catalog C-85 which has the complete story on MARVEL Hack Saws and Band Saws, Hack Saw Blades and Band Saw Blades.

ARMSTRONG-BLUM MFG. CO.

5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS

Better Machines—Better Blades

LECTRA-FORM
Increases Production 500%

Ex-Cell-O Model 244 machines recess 5 times faster, with far lower tool cost!

Ex-Cell-O LECTRA-FORM Machines remove metal through high-current, low-voltage electrical spark discharge. Producing an inverse image of low-cost shaped rod, tubing or sheetmetal tooling, LECTRA-FORM accurately drills, pierces, trepans, slots, cuts or sinks intricate cavities in carbides and other conductive materials difficult or costly to machine by other methods.

Contact your Ex-Cell-O Representative for details, or write for LECTRA-FORM Bulletin 436014.

Model 244 has an electro-hydraulic servo for automatic tool feed and gap control, removes metal without distortion due to tool pressure. Inset photo shows part before and after 8-minute LECTRA-FORM machining.

HERE'S HOW LECTRA-FORM COMPARES TO CONVENTIONAL MACHINING

WORKPIECE Nickel-alloy aircraft part*	LECTRA-FORM MACHINING	FORMER METHOD
Tooling	Low-cost brass rod	Small end-mill cutter
Tool cost	Negligible	High wear and breakage
Accuracy	Uniform wall thickness	Distorted wall contour
Machining time	**8 minutes**	**40 minutes**

*Depth of recess approx. .080", wall thickness approx. 1/32".

61-30M

EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Always

FIRST!

in their field . . .

Gusher

COOLANT PUMPS

The original motor driven centrifugal machine tool coolant pumps.

First precision made dynamically balanced coolant pumps — *comparable in workmanship to the machine tools they serve.*

First ball-bearing prelubricated coolant pumps requiring no seals . . . no priming . . . minimum maintenance.

First with split-second coolant flow from the moment that the machine is turned on.

Follow the leading machine tool builders . . . specify Gusher Coolant Pumps on your machines.

Write for free catalog

Ruthman

MACHINERY CO.

1819 Reading Rd., Cinn. 2, Ohio

LETTER from the PUBLISHER

The ABC of It

Periodically, you receive a simple questionnaire from us asking you to provide certain information: Your job title, your function or area of responsibility, the name of your company, the products manufactured by your plant, etc. Perhaps you've wondered about the purpose of this questionnaire. Perhaps you've said to yourself: "Why bother?"

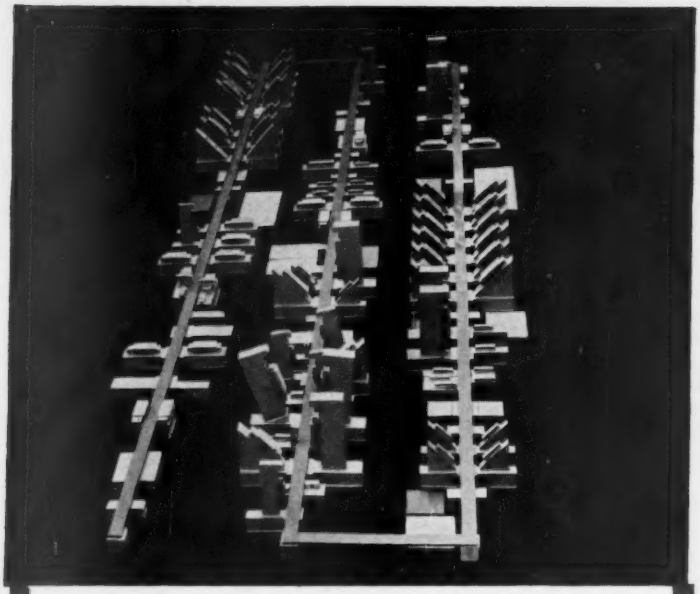
To serve you editorially . . .

One of its major purposes is to enable our editors to do a better job of serving *you*. The more they know about your job interests and responsibilities, the kinds of products you manufacture, the types of manufacturing operations carried on at your plant, the better job they can do of editing AMERICAN MACHINIST/METALWORKING MANUFACTURING in your direct interest. The information you supply helps them to be sure they are providing you with the kind of technical material and reports on new developments you can apply directly to your manufacturing operation.

To give you informative advertising . . .

An important part of any technical publication is its advertising. To serve you properly the advertising, just as in the case of the editorial content of the publication, needs to be informative, geared to your interests. Thus, the *advertiser* is also interested in the information you supply. This is treated by us as confidential and is used statistically only. The information is audited for accuracy and completeness by what is known as the Audit Bureau of Circulation (established in 1914) and supplied to the advertiser statistically on a form known as an ABC Statement. These statistics are an important tool for him in making sure his advertising in AM/MM is informative and useful to you. So, the next time you receive one of these questionnaires you'll want to fill it out as completely as you can. It helps us to serve you.

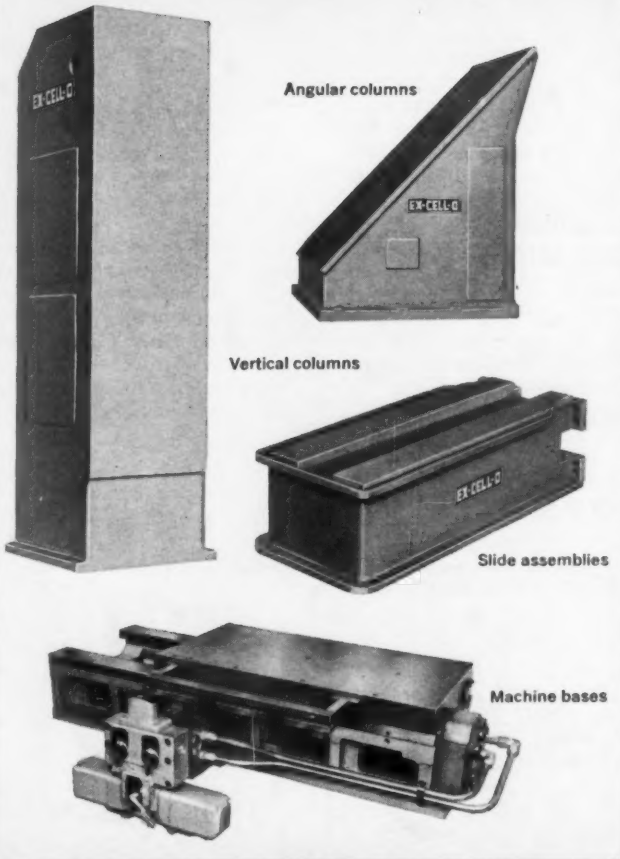
George Reppert



For economy, productivity, flexibility... EX-CELL-O BUILDING BLOCK UNITS!

- You get custom equipment, made from low-cost, standardized units.
- You can build simple one-way precision machines, or huge multi-station transfer machines.
- You can remove, relocate or add work stations to suit your production needs.
- You can arrange components for horizontal, angular, radial or vertical machining.
- You can partially or completely automate any sections.
- You can set up single or multiple functions—bore, counterbore, turn, drill, ream, face, chamfer and other operations.
- You can re-tool with standard Ex-Cell-O spindles, hydraulic power units and other accessories—and *know* all units will fit perfectly.
- You get faster delivery because standardization reduces engineering and build-up time.

If you're looking for manufacturing flexibility, look into Ex-Cell-O Building Blocks. Call your Ex-Cell-O Representative, or write for Bulletin 505911.



61-29M

EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Save time and money day in and day out. With a Minute Man Keyway Broach you can cut a keyway by hand, in an arbor press, **in one minute** for **as little as one cent.** Available individually or in kits complete with broaches, bushings, shims and keystock. For keyways from 1/16" to 1" in any bore ¼" to 3".

SAVINGS WITH STANDARD SQUARE BROACHES, TOO.

For finishing ⅛" to 1" square holes in one pass in cast or drilled bore. (32nd size, too)

The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

duMont

LETTERS

to the editors

330 W 42nd St, New York 36, NY

An Extra Zero, but Where?

Dear Sirs:
The item on "Oxide Tools" on your "Talking Shop" page (*AM/MM*—Mar 20 '61, p153) says, "For the finish operation the speed is 760 rpm, for a 800 sfm speed . . ."

Since you say the blanks are 40 in. OD, the surface speed would be 8000 sfm, not 800.

Leroy R Shearer
Los Angeles, Calif

There was a mistake in the item, but that's not it. Our informant tells us that somebody's typewriter got too enthusiastic and added a zero to 76 rpm. The surface speed actually was 800 sfm.

Cemented oxide tooling has been run as high as 8000 sfm, but the usual range is up to about 2000 sfm—Ed.

Small Turbojet Engine

Dear Sirs:
Your "Detroit" page (*AM/MM*—May 15 '61, p113) carried an article called, "Tempest in a can." We are highly interested in the Williams Research Corporation's WR 2-1 turbojet engine and would like to be informed where this company is located. We would also like to receive, if possible, information and literature on the above product.

J Johnson
Chicago, Ill

The best source for further information is Sam B Williams, president, Williams Research Corp, 2280 Maple Road, Walled Lake, Mich—Ed.

Another Vote for Meters

Dear Sirs:
Your "Letter from the Publisher" called "About Change," (*AM/MM*—Apr 17 '61, p84) was very interesting to me. What it states is very true; falling in love with one's own products is a dangerous thing.

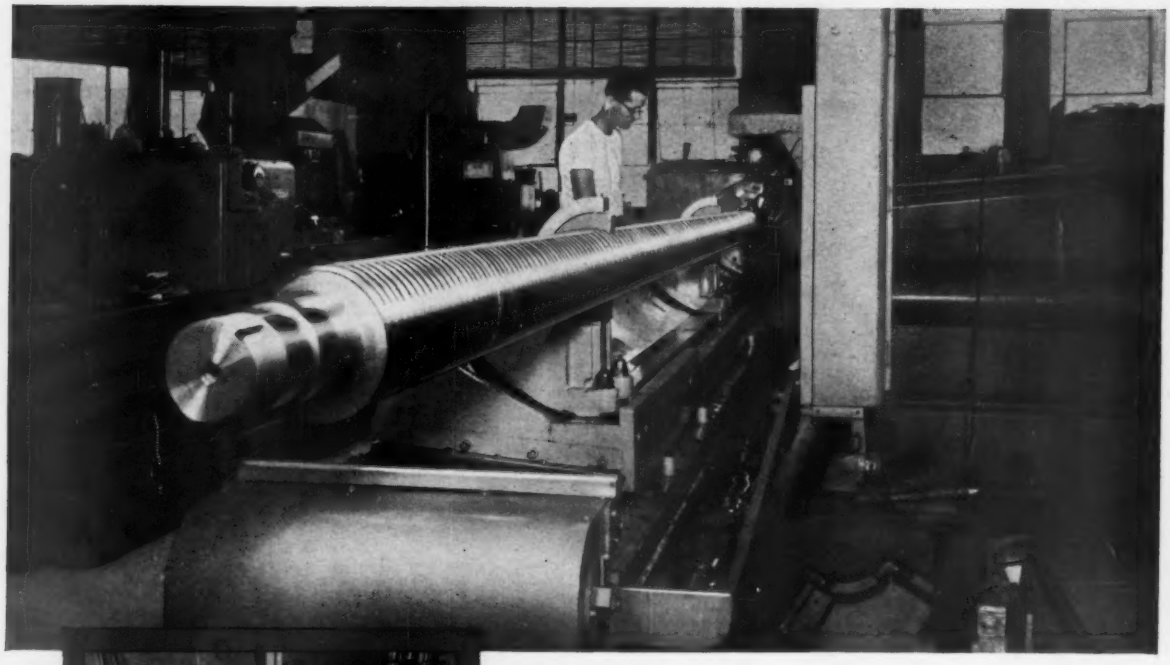
But what about the biggest love in the English-speaking countries, their outdated measuring system? Tremendous sums are lost every day in using this clumsy system of measurement.

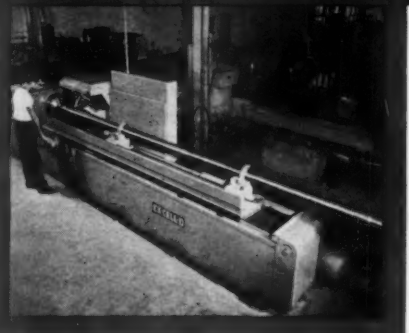
On that point Russia and Japan, and even China, are ahead of the

SHOPMATES

N. Jarvis

FAST DELIVERY of Lead Screws and Threaded Parts!





The lead screw shown above in a Model 120 Ex-Cell-O Thread Grinder is 19 feet long, 5 inches in diameter. Guaranteed tolerance is ± .0002" per inch, ± .0005" per foot, non-accumulative.

- All thread forms
- Any size, any quantity
- Regular, worm or ball-race
- Guaranteed accuracy

Ex-Cell-O can quickly deliver custom lead screws and threaded parts in any quantity, in any size from miniature to twice the length of the 19-foot screw illustrated. Thread types include worm, ball-race, Acme, Modified Acme, Buttress, Whitworth and others in all classes, I.D. and O.D.

The Ex-Cell-Ability to design, develop and produce precision parts to your specifications is amply supported by modern quality control, heat treatment, machining and inspection methods and fast service. For a prompt quotation, contact our Representative nearest you, or send us your prints.

61-313

EX-CELL-O FOR PRECISION

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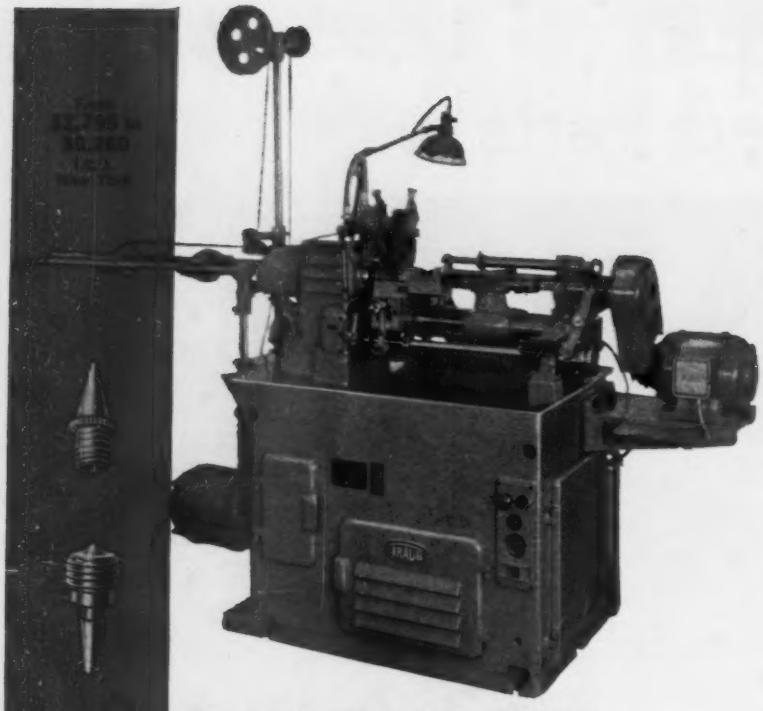
Precision Parts Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



SIMPLICITY
the key feature of
TRAUB AUTOMATICS

- Simple to set up
- Simple to operate
- Simple to maintain

TRAUB Single Spindle Bar Automatics can be used for both bar and chucking work. They produce efficiently, with the highest precision, and economically even on 50 piece runs. Every model is carefully tooled and job-proved before delivery and reliably serviced thereafter.

Single Spindle Bar Automatics come in 4 different models.

MODEL	A 15	A 25	A 42	A 56
COLLET CAPACITY	19/32"	1"	1⅝"	2¼"
12 SPINDLE SPEEDS	900-6,500 RPM	550-4,000 RPM	240-2,920 RPM	240-2,920 RPM

TRAUB Automatics are stocked in the U. S. and spare parts are readily available. TRAUB's factory-trained technicians stand ready to assist you anywhere in the U. S.

Write for illustrated catalog. Ask for a demonstration.

TRAUB

TRAUB U. S. A., INC.
38-31 Crescent Street, Long Island City 1, N. Y.
Phone: EXeter 2-4090

A direct-factory affiliate of Hermann Traub Machine Tool Works
Reichenbach Fils, West Germany Dielsdorf, Switzerland

U S, and it appears now that even old England is about to change to the metric system. I think that, if *AM/MM* would act as a spearhead for this reform, which would benefit the whole world, the change would be an easy matter.

A E Fristedt
Stockholm-Bromma, Sweden

We appreciate Reader Fristedt's faith in AM/MM, *but we believe he overestimates our influence. As the change to the metric system would obsolete almost all dimensional standards, even down to those for nuts and bolts, the practical complications of the change are far greater than usually realized.*

There is hope for simplification, however, in the current trend toward decimals and away from fractions for subdividing the inch. In many cases, the decimal equivalents are simply substituted for the fractions, but the decimals will soon be recognized on their own —Ed.

Cartoon Scores Hit

Dear Sirs:

One of your recent cartoons (*AM/MM*—May 15 '61, p263) laid our Product Planning Department people in the aisles. [*For another look at this cartoon, see below*—Ed.]

Our Product Planning Department people daily meet with inventors, and they feel that a blow-up of this cartoon on their office walls would help their state of self control.

May we have your permission to make a blow-up for such use?

Norman S Maxwell
sales promotion mgr
Navan Products, Inc
El Segundo, Calif

Permission granted—Ed.

AM/MM

"The evaluation committee not only turned down his suggestion but they also turned down any others he might make in the future."

CALENDAR

Society of Automotive Engineers —Farm, Construction, and Industrial Machinery Meeting, Sept 11-15, Milwaukee Auditorium, Milwaukee, Wis.

Instrument Society of America—Annual Meeting and Automation Exhibit, Sept 11-15, Memorial Sports Arena, Los Angeles, Calif.

Pressed Metal Institute—Annual Meeting, Sept 24-28, Grand Hotel, Point Clear, Ala.

American Welding Society—National Fall Meeting, Sept 25-28, Adolphus Hotel, Dallas.

American Die Casting Institute—Annual Meeting, Sept 27-28, Edgewater Beach Hotel, Chicago, Ill.

American Production & Inventory Control Society — National Technical Conference & Exhibit, Sept 28-29, Pick-Congress Hotel, Chicago, Ill.

American Machine Tool Distributors Association—Annual Meeting, Oct 4-6, Penn Sheraton, Hotel, Pittsburgh, Pa.

Society of Automotive Engineers —National Aeronautic Meeting and Display, Oct 9-13, The Ambassador, Los Angeles, Calif.

American Standards Association — National Conference on Standards, Oct 10-12, Rice Hotel, Houston, Texas.

Magnesium Association — Annual Convention, Oct 16-18, Belmont Plaza Hotel, New York, N.Y.

National Safety Council — National Safety Congress, Oct 16-20, Chicago, Ill.

America Institute of Mining, Metallurgical & Petroleum Engineers — Metallurgical Society Fall Meeting, Oct 23-26, Pick-Fort Selby Hotel, Detroit, Mich.

American Society for Metals — National Metal Exposition and Congress, Oct 23-27, Cobo Hall, Detroit, Mich.

Society for Nondestructive Testing — Annual Convention, Oct 23-27, Henrose Hotel, Detroit, Mich.

A super-finish saw so tough it can't scratch itself.

NEW

Brown & Sharpe

Sawperior

GREATEST ADVANCE IN SLITTING SAWS IN 50 YEARS!

The mirror-like finish of new B&S "Sawperior" slitting saws mark 3 new developments that more than double production and make other saws virtually obsolete!

NEW Alloy High Speed Steel for Longer Life.

NEW Tooth Design for Fast Free Cutting!

NEW Super-Finish prevents Chips Seizing and Galling!

PRODUCTION BENEFITS

Shop tests prove the new tooth geometry and mirror-like finish give up to 4 times as much slitting production between sharpenings.

Super finish on sides permits use of less concavity or side clearance thereby providing a stronger saw section and a stiffer, more accurate saw.

Smooth side finish resists scratching, resists corrosive action of coolants and rust.

New saw design requires less milling machine power thereby allowing heavier cuts without strain or chatter.

New saw geometry and super finish sides give smoother surface finish in cut.

Send for B&S Cutting Tool Condensalog . . .

For that EXTRA Edge in Production!

Brown & Sharpe

Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

NOW 3-AXIS NUMERICAL CONTROLS FOR B&S TURRET DRILLS

HUGHES 3-AXIS NUMERICAL CONTROLS are now available as original equipment on Brown & Sharpe turret drills. With 3-Axis control, operation is completely automated—more work at less cost. Each spindle can be programmed for multiple drill depths. Feed speeds are tape controlled. Set-up time is reduced more than sixty per cent. And—as with all Hughes Numerical Controls—jigs, fixtures and templates are eliminated. Fitting 3-Axis controls to B & S turret drills is another "first" for Hughes. And you get proven reliability through Hughes' long experience in numerical controls. Hughes' transistorized circuitry, modular construction, and photo-electric tape readers mean more "up-time," increased production and less maintenance. Hughes ULTRA-RELIABILITY adds up where it counts—in your profits.

SPECIFICATION SUMMARY

Axis controlled	X	Y	Z
Range of movement	20"	15"	9"
Accuracy	±0.001/ft.	±0.001/ft.	±0.002/ft.
Repeatability	±0.0002/ft.	±0.0002/ft.	±0.001/ft.
Position Speed (in./min.)	160"	160"	180"

Find out more about 3-Axis (or 2-Axis) Hughes Numerical Controls. Ask your B&S distributor, or write, wire, teletype (TWX INGL 4117) or call: Hughes Industrial Control Systems, Dept. No. 92-21, P.O. Box 90904, Los Angeles 45, California.

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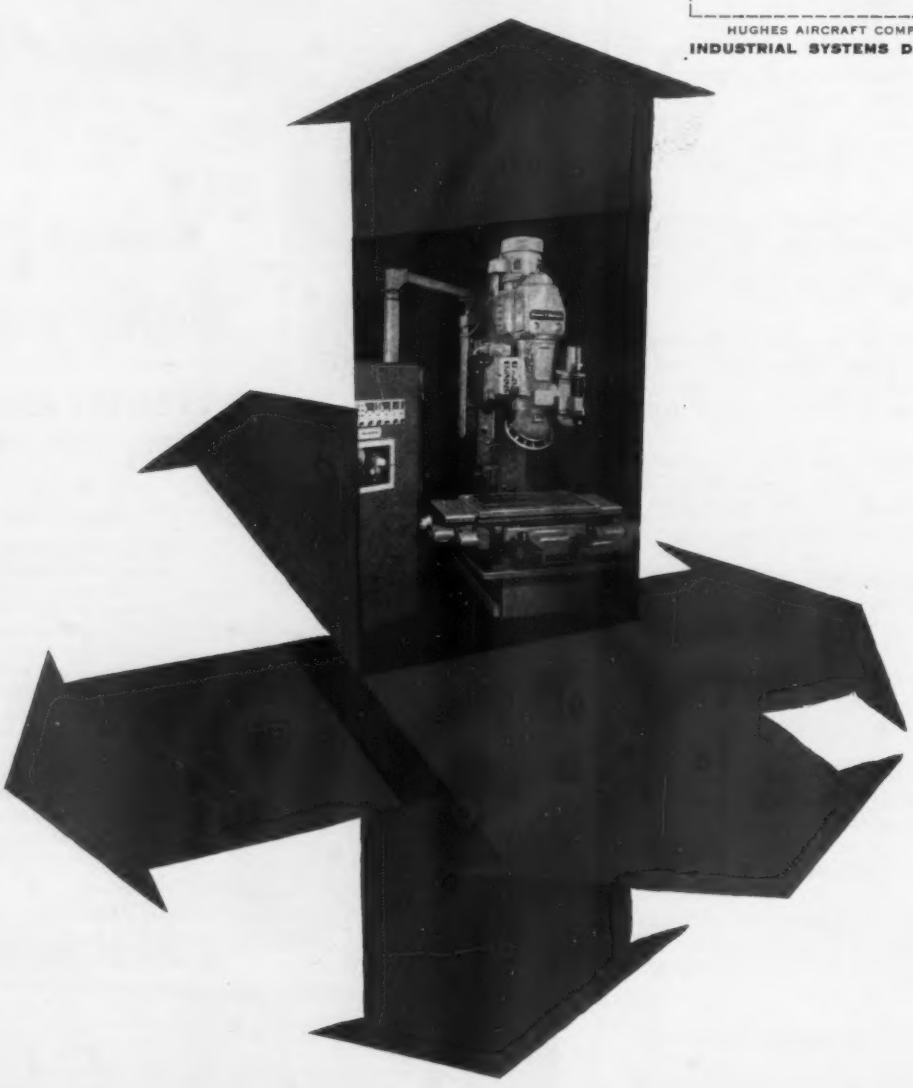
HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION



SPOT NEWS...

- **International Harvester's Memphis (Tenn) Works' new nodular iron foundry,** reportedly the largest and most modern in the south, will house all IH nodular iron production and will supply castings for all IH plants in the motor, farm equipment, and construction equipment industries.

- **133,511 metal-cutting machine tools and 49,631 metal-forming machines** were shipped to customers by U S builders during 1960, according to a report just published by the Bureau of the Census and the Business and Defense Services Administration. If machines valued under $1000 are eliminated, the figures would be 42,914 for cutting machines, 19,311 for forming machines.

- **Soviet trade fair in London spotlighted about a dozen Russian machine tools,** including a horizontal boring machine; multi-spindle vertical automatic; gear grinder with vertical work spindle, using a formed wheel to grind two tooth flanks simultaneously; surface grinder with automatic size control; and a double-ended boring machine. Fair was held earlier this month and was about twice the size of the Soviet Fair held in New York two years ago.

- **Four solutions to the unemployment situation brought on by automation** have been offered by the House Labor Subcommittee: (1) Federal assistance to the unemployed "to undertake further education," (2) financial aid to states to undertake retraining programs, (3) expansion and improvement of U S Employment Service to match workers and jobs, and (4) relocation of workers displaced by automation to new areas where jobs are available.

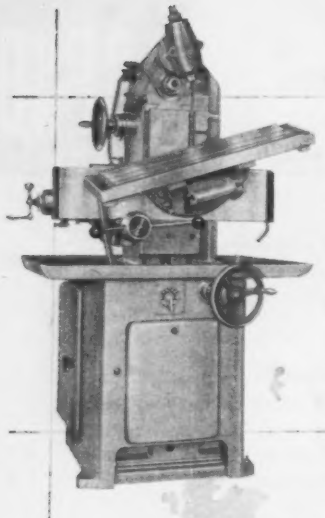
- **The Cardinal, Ford's compact-compact, may be built in Germany and the U S.** About 2000 dies have been shipped back from Cologne to this country (Reasons vary: Some say German costs were too high and that there were production delays; others say that there were not enough heavy presses in Europe), but the feeling is that both countries now have a full set of tooling. The European version of the car will probably have all-European parts; the American version, a mixture of U S and European.

- **Reported to be the world's largest self-contained press brake,** the Verson press just installed at Harnischfeger (Milwaukee) can deliver a pressure of 2000 tons—enough to shape sections of super-strength steel as large as 26 feet wide and 1¼ inches thick. Press has a 24-inch stroke and four different pressing speeds in increments from 5 to 24 inches per minute.

- **Automatic machinery for use in the Shaw Casting Process** will be developed by Feco, Inc, a newly formed company that is jointly owned by Avnet Electronics (Westbury, NY) and Foundry Equipment Ltd of England, builders of automated foundry equipment. Machines are expected to be ready for delivery in the United States within the next few months.

- **Detroit's Cobo Hall and organized labor have signed an agreement** covering basic ground rules for setting up, operating, and dismantling of expositions. The American Foundrymen's Society, which will be exhibiting there in May, 1962, helped develop the rules. The rules are designed to establish indisputable authority and responsibility for all services and costs.

- **Russian hydraulic press plant at Tambov is producing 25-ton presses** for export to underdeveloped countries, according to reports from inside Russia. Presses are to go to UAR, India, Guinea, Iraq, Rumania, and East Germany. Next year, the Soviets say, the plant will begin production of 40- to 63-ton presses.



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Model F-2—9" longitudinal
9" vertical—5" transverse
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12" vertical—5¼" transverse
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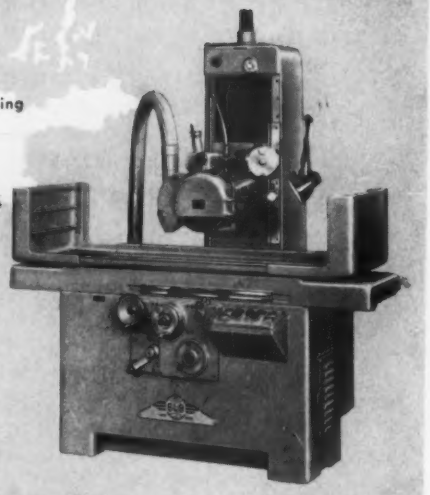
17½" vertical—7" transverse

Plus a full line of precision drilling and tapping machines.



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ALINA
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◂ TSCHUDIN
Universal Grinders

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3 sizes available: 8" x 12", 8" x 16", 8" x 24".

MONDIALE ▸
Engine Lathes

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MODEL	SWING	SWING OVER GAP	NO. OF SPINDLE SPEEDS	MAX. SPINDLE RPM	H. P.
Gallic #16	16"	—	16	2000	10/7.5
Celtic #12	12"	—	16	2000	3/2
Celtic #14	14"	21⅛"	16	1600	3/2
Celtic #17	17"	25"	16	1350	6.5/4
Celtic #20	20"	30"	18	1000	6.5/4

See these and other machine tools at fully equipped showrooms in: Chicago, Ill. • Detroit, Mich. • Los Angeles, Calif. Philadelphia, Pa. • San Francisco, Calif. • Seattle, Wash.

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318

WASHINGTON...

New strike weapons talked . . .

Within a month the Kennedy administration will ask Congress to give it an "arsenal of weapons" to handle national emergency disputes.

Disenchanted with the Taft-Hartley Act's 80-day injunction which it used in the maritime strike, the administration wants a variety of choices in tackling major disputes.

The proposals will include power to appoint fact-finding boards to make settlement recommendations, power to seize an industry and order retroactive pay adjustments, authority to call labor and management into the White House and order a settlement.

There's one troublesome issue the administration as yet has no answer for. Federal officials blame the current maritime and airline disputes on inter-union rivalries, and on management and labor's failure to agree. They want a formula that would help to break up the contests now raging between the National Maritime Union and Seafarers Union in the maritime disputes, and between the airline pilots and flight engineers in the airline case.

Without this feuding, these disputes might be settled by now. The administration's aim: to have the tools but not to tip its hand on what's coming, so the parties will concentrate on getting a settlement in negotiations without waiting to be bailed out by the government.

GAO raps Pentagon on machine tools

General Accounting Office has reported to Congress that "inadequate management and coordination" of military-owned machine tool inventories are boosting defense costs. The agency raps the Defense Department for failing to centralize more strongly the administration of idle production equipment owned by the Services.

GAO's prime complaint: In the past five years, the Services have bought 53 machine tools and other types of production equipment "unnecessarily because of failure to screen and use idle assets." Total cost of the machines was $705,500. Included were a vertical turret lathe, shapers, grinding machines, milling machines, and others. GAO's report is not meant to be comprehensive.

In addition to the charge of failing to use suitable idle tools, GAO criticizes the Pentagon for allowing the Services to use different identification systems for production equipment and for tolerating "costly duplication and overlap of management functions and organizations" to run the machine tool program.

In response to GAO's charges, the Defense Department is studying ways to revamp management of the machine tool program. One scheme being considered is to set up a "single manager" to buy tools and handle inventories of idle machines. This would be one military agency doing all the procurement and supply management of metalworking equipment for each of the Services.

The Department is also tightening up current policies for screening and identifying machine tools and calling for more centralized management of production equipment by the Services.

Licensing deal for Russian designs . . .

National Patent Development Corp, which describes itself as a "patent marketing" organization, has been given exclusive rights to negotiate licenses in the U S for use of Russian-invented metalworking designs and processes.

The corporation, headquartered in New York, has signed contracts with the Soviet government granting it authority to sublicense to U S companies use of Russian inventions in the electronics, ultrasonics, and medical instrument field, as well as machine tools.

In Russia, the corporation's president, Jerome Feldman, was quoted as saying the Soviet developments "represent real technological breakthroughs."

But the corporation's chairman, Jesse Larson, a former Truman administration official and now a Washington lawyer, is still unable to provide details on the types of processes and equipment involved in the licensing deal. The U S company had unsuccessfully tried to get recognition in the Soviet Union for U S inventors whose patents are being used there without compensation.

Ban on defense advertising . . .

Defense contractors are up in arms over a provision in the House-passed Military Appropriation Bill which would, in effect, prohibit them from advertising.

The bill bars "availability" of Defense Dept funds "for paying costs of advertising by any defense contractor," states that "such costs shall not be considered a part of any defense contract cost."

Under present rules, contractors are allowed to charge off as a contract cost only a very limited amount of advertising expenses—for the most part, institutional ads in technical journals and help-wanted advertising.

They "Go Together" For

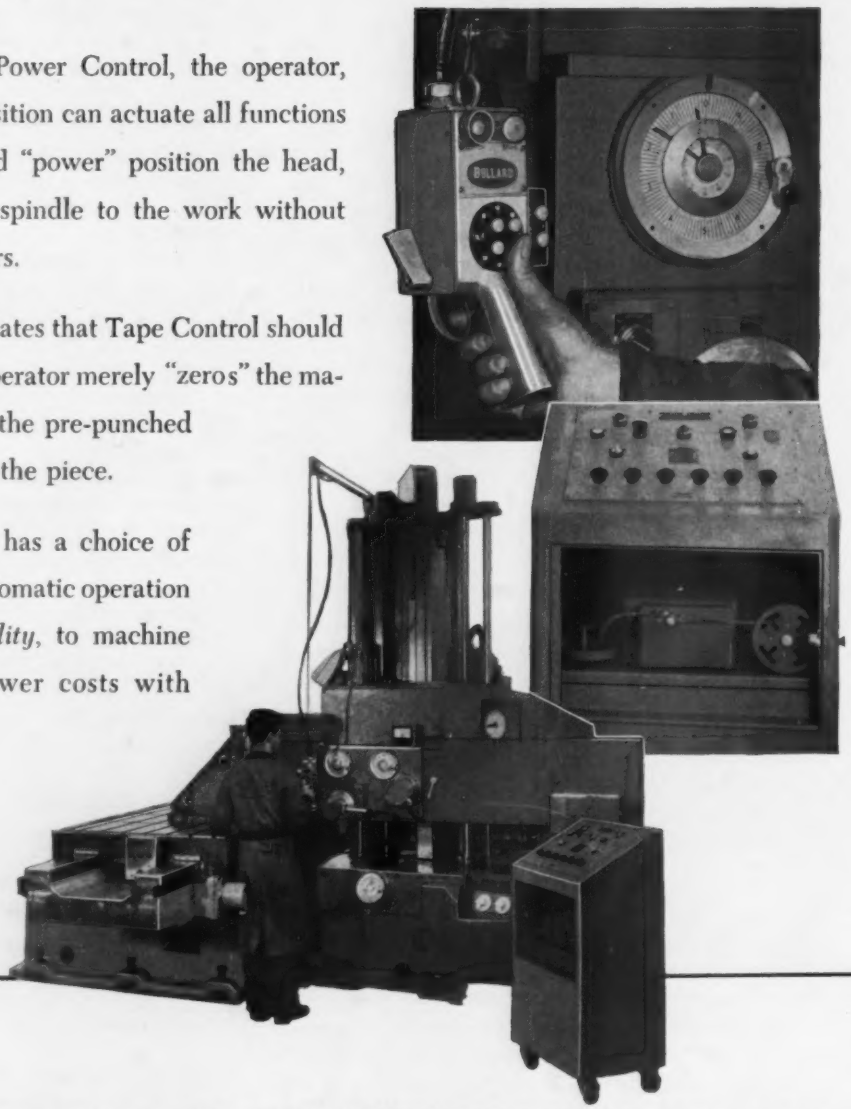
CENTRALIZED POWER CONTROL for manual operation and **NUMERICAL TAPE CONTROL** for automatic operation provide complete versatility of the Bullard DYNAMILL H.B.M. to insure maximum production.

Complete Versatility

With Centralized Power Control, the operator, from his normal position can actuate all functions of the machine and "power" position the head, table, saddle, and spindle to the work without hand cranks or levers.

When the work dictates that Tape Control should be employed, the operator merely "zeros" the machine according to the pre-punched tape for machining the piece.

Thus, the operator has a choice of either manual or automatic operation — *complete versatility*, to machine more pieces at lower costs with increased profits.



BULLARD

For Complete Information on the Bullard DYNAMILL H.B.M., call your nearest Bullard Sales Office or Distributor or write The Bullard Company, Bridgeport 9, Connecticut.

DETROIT...

More aluminum engines coming . . .

Doehler-Jarvis Division of National Lead Company, which makes American Motors' die-cast six-cylinder aluminum engine block, appears to have solved the problem of die-casting a complex overhead-valve aluminum cylinder head. Presently, the Rambler aluminum engine performs with a cast-iron cylinder head, but this is scheduled to change when 1962 lines are introduced. American Motors will replace the cast-iron head with an aluminum one.

Chrysler Corporation will build more aluminum engines this year. Only a handful of the lightweight slant-sixes were produced during the 1961 model run. The 1962 powerplant will probably be optional for the fullsized Pymouth and Dodge, as well as the Lancer and Valiant.

Despite rumors to the contrary, Buick will continue to offer the optional V-8 aluminum power package, even though its well-publicized V-6 will be standard equipment. The V-6 will be cast iron and liquid cooled. Aluminum V-8's are optional on Pontiac Tempest and Oldsmobile F-85 compact models in addition to Buick.

General Motors is believed working feverishly on a die-cast aluminum engine for B-O-P compacts.

Less grease will be needed . . .

Virtually all the new cars will follow the route to sealed lube joints with a 30,000-or-so-mile re-lubrication interval, or factory-sealed for the life of the vehicle. Ford products will stand pat with the 30,000-mile figure of last year even though its engineers are confident that the factory-installed lubricant will last the life of the car under normal driving conditions. Owners of Ford's new "midde size" cars, coded "Canadian X" and "Canadian Y" while under development, will also find a recommended 30,000-mile lube interval in their instruction manuals. When the 1962 models make their debut, it is believed that General Motors will go the "lifetime" route on chassis lubrication, following Cadillac's example.

This leaves Chrysler Corporation of the Big-Three, and word is that its cars will go to a 32,000-mile interval this year. If Studebaker and American Motors do not introduce a lubeless chassis this year, they will do so by 1963.

New car lineup . . .

Though tooling expenditures this year indicate that most current nameplates will undergo little more than sheetmetal face-lifts, at least three new cars are scheduled for introduction this model year (with somewhat more cautious fanfare than the ill-fated Edsel), and some new body styles will be seen for others.

Ford Motor Company has two new models for 1962. They were coded "Canadian X" and "Canadian Y". The first replaces the Ford Fairlane; the second, almost identical but longer, replaces Mercury's Meteor. They will carry the Fairlane and Meteor labels, but feature a crisp, angular design, somewhat T-Birdish, and be V-8s.

Chevrolet's so-called H-35 (a code name only) will probably wind up being tagged the Corsair or Nova, though Nova may be the top series only. It is a 115-inch-wheelbase car designed to displace the low-priced Chevrolet Bel-Air and Biscayne models and fit in between Corvair and the Impala series. There will be a sporty convertible model powered by a peppy V-8 somewhat smaller than Chevy's standard.

It appears that standard H-35s will be powered with the regular, reliable Chevrolet six or, optionally, a new cast-iron four-cylinder, overhead-valve engine.

Lots of convertibles . . .

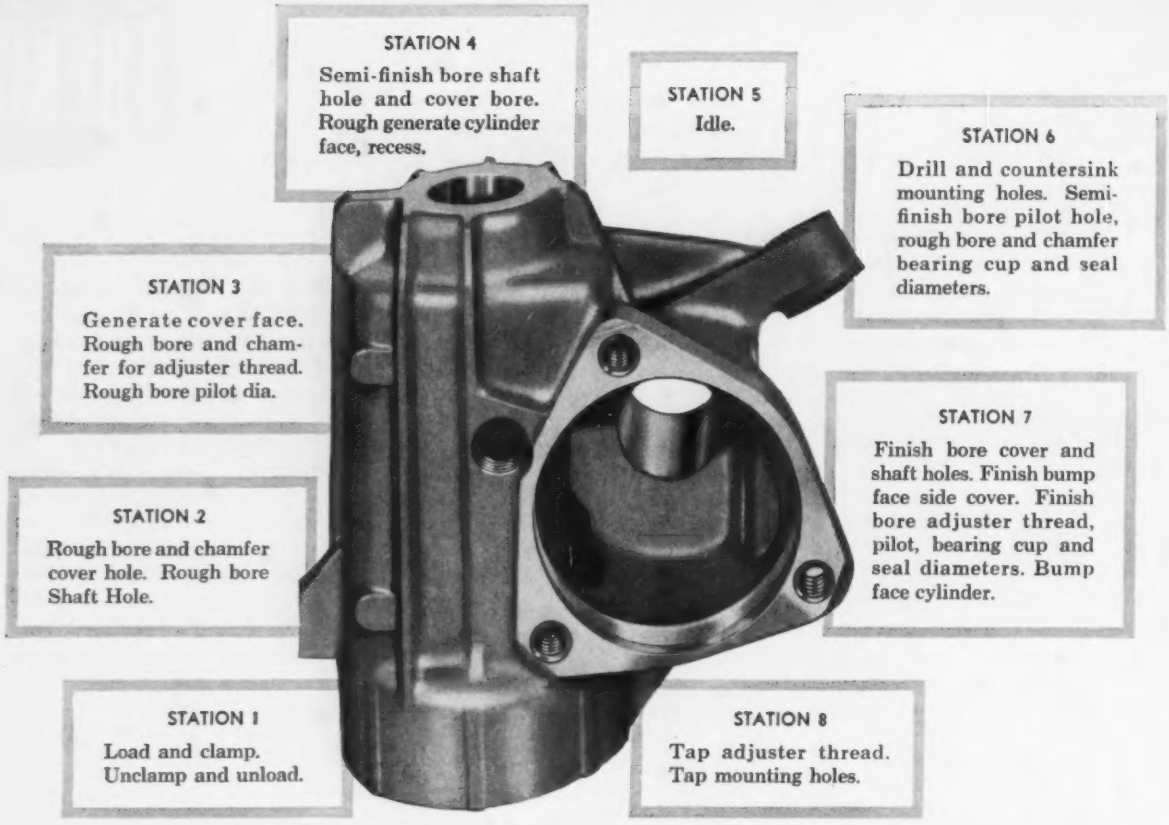
Valiant, Lancer, Tempest, Buick Special, F-85 are the existing compacts that will introduce convertibles to the lineup when the new cars are shown. Falcon, Comet, and Corvair are expected to show their soft-top models next spring. Studebaker and American Motors make convertibles at the present time. In fact, the Rambler American showed the rest that the market for such a car exists.

Lincoln-Continental, which backed-off introducing its four-door hardtop last year, will do so in September. This will bring to three the number of body styles built by Continental. Chrysler will no longer make Windsors, but the 300 series will include a new four-door hardtop. All Plymouths, including the top lines, will be squeezed onto a 115.5-inch wheelbase and shortened a full six inches. Dodge Dart will suffer similarly. Chrysler Corporation is also readying a luxury sports model.

Studebaker cars will probably experience the greatest change in appearance. That auto-maker is also developing a slanted four-cylinder engine similar to that in the Tempest. It could be ready for 1962 cars.

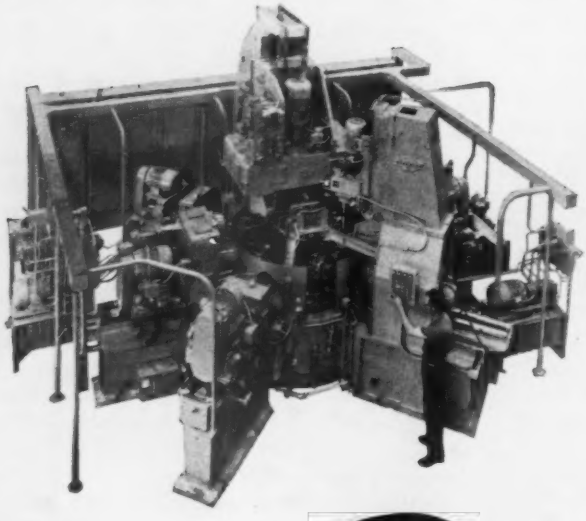
Pontiac, Buick, and Oldsmobile will again be similar, both to one another and to 1961 models. Minor changes in front and rear and a plush luxury model in each line are scheduled.

Those eagerly awaiting the Cardinal can exhale. It won't show up in the United States until next spring at the earliest.


STATION 4
Semi-finish bore shaft hole and cover bore. Rough generate cylinder face, recess.
STATION 5
Idle.
STATION 6
Drill and countersink mounting holes. Semi-finish bore pilot hole, rough bore and chamfer bearing cup and seal diameters.
STATION 3
Generate cover face. Rough bore and chamfer for adjuster thread. Rough bore pilot dia.
STATION 7
Finish bore cover and shaft holes. Finish bump face side cover. Finish bore adjuster thread, pilot, bearing cup and seal diameters. Bump face cylinder.
STATION 2
Rough bore and chamfer cover hole. Rough bore Shaft Hole.
STATION 1
Load and clamp. Unclamp and unload.
STATION 8
Tap adjuster thread. Tap mounting holes.

153 Aluminum Steering Gear Housings per hour

automatically processed on this GREENLEE Machine



This Greenlee 8-Station Horizontal and Vertical Spindle Machine is establishing some excellent performance records for a leading automotive manufacturer. The 52 inch table carries 8 work fixtures. Each has power clamping. To insure rigidity and accuracy, the table is clamped hydraulically metal to metal. Indexing is fully automatic. Cycle time is 23.5 seconds. Like all Greenlee machines it's built for long, continuous service. Can be modified economically if desired. Have our representative give you complete information.

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AIRCRAFT and MISSILES...

TRENDS

More defense spending?

Pressure for still another round of increased defense spending—especially for aircraft and missiles—is mounting in Washington. The Soviet's intensified truculence on Berlin, Khrushchev's plan to boost Russian military expenditures by 35%, and the recent revelations of Soviet airpower advances, as demonstrated at the Moscow Air Show, are being used to prod the Kennedy administration to boost the Pentagon's budget for the third time this year.

The President has ordered the Defense Department to make another "review" of military needs in light of the Kremlin's latest round of saber-rattling. But the upshot seems likely to be some shifts in what the Pentagon experts call "tactical plans and operational concepts" rather than any costly long-range program to buy more hardware, above and beyond latest budget schedules.

Under study are plans to call up some reserves, deploy more combat forces to Europe, strengthen the Berlin garrison, order an airborne bomber alert, and similar readiness measures. Additional spending would be invloved—a couple of hundred million dollars, perhaps—but only minor amounts of extra procurement would be required.

Congress is putting the heat on the White House to expand the manned bomber program. The House has already tacked on $448.8 million of the Air Force's appropriation for continued B-52 or B-58 production or to speed development work on the B-70. The Senate, looking with awe upon the Moscow Air Show, is likely to add even more money. Most significant new items in Russia's air armada: Intercontinental and medium-range bombers apparently capable of supersonic speeds, and two new fighter planes which appear to have speeds of at least Mach 2 and are armed with advanced air-to-air missiles.

A real "nuts and bolts" contract . . .

Republic Aviation has received a $350,000 contract for the development of rivets, bolts, and other mechanical fasteners that can withstand the stresses of space environments. The contract, from the Air Force's Aeronautical Systems Division, Wright Field, calls for service temperatures in the range from 2000 to 4500 F.

Republic engineers will work with molybdenum, columbium, and tungsten in developing these fasteners for use in construction of future flight vehicles operating in both terrestrial and space environments.

Critical factors that will be stressed in the design will be the tendency of the fastener material to become contaminated or oxidized at high temperatures, and the effects of vacuum and radiation. The project will be a joint effort of Republic's Structures group and its Manufacturing Research and Processes department.

How strong are shear-formed parts?

The Air Force's Aeronautical Systems Division would also like to know what effect shear-forming has on the mechanical properties of metals. It has awarded Temco Electronics & Missiles Co (Dallas) a contract calling for a 15-month study on the properties of 32 metal alloys shear-formed to conical shape.

Data on hardness, tensile strength, shear strength and microstructure "will be used to advance the use of the shear-forming process, and to contribute to our knowledge of structural design," says Frank Jacobs, Jr, Temco Material and Process group engineer.

Lockheed builds a "hummingbird"

Lockheed's Georgia Division is building a research aircraft for the Army that will fly like a hummingbird—straight up, straight down, hover in mid-air, and straight forward—all at jet speed.

Army's Transportation Research Command, Fort Eustis, Va, will use the aircraft in various research flight programs to test the jet ejector lift principle.

Heart of the proposed aircraft is a system of ejector mixing chambers buried in the fuselage. These chambers are fed by high-velocity exhaust diverted from the two, 3000-lb-thrust jet engines mounted in pods along either side of the fuselage.

As now envisioned, the craft will be a two-place, mid-wing monoplane with a wingspan of 25 ft 8 inches and an overall length of 32 feet.

Aerospace employment gains . . .

Employment in the aircraft and missile industry over the whole country shows a slight gain in the last few months. According to Aerospace Industries Association figures, January employment was about 643,000. This rose to 647,000 by March and has increased another 1000 to 1200 since then.

These figures, of course, include many of the electronics people who put the miles of wire, hundreds of tubes, and little black boxes into the aircraft and missiles.

Relax! it's a Cushman chuck*

CUSHMAN

MANUALLY OPERATED CHUCKS

* Cushman Manually Operated Chucks provide spindle-matched accuracy, repeatability and a long service life.

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INDUSTRIAL DISTRIBUTORS

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MACHINE TOOLS...

Holden likely to buy here . . .

Biggest current tooling program is for the new Holden (Australia) engine by General Motors. Some machine tool builders have put in bids, but it seems likely that few orders will be placed until August (though a few companies are known to be about ready to ship machines to Holden on previous orders). Total Holden outlay is estimated at $12 million as a minimum and $20 million maximum.

Though British builders have a price advantage in Australia, partly because of the Commonwealth preferential tariff, General Motors is understood to be leaning toward placing the bulk of the Holden business with U S builders because of much better deliveries.

Certain high-production machine builders are reported delivering machines to India. Tata has been seeking bids on machines for making engines for trucks of Mercedes design.

No inquiries for '63 tooling . . .

Just now there is a conspicuous lack of inquiries for new tooling for 1963 models to be introduced in the fall of 1962. Whatever talk there has been has been mostly conversation and that's all.

One experienced builder interprets this as an indication that auto companies have not yet made up their minds what they want.

A sizable percentage of inquiries received by a prominent press builder has been for cold extrusion work. Many of the inquiries have come from foreign customers who seem more willing than domestic firms to "take a chance" on cold extrusion.

Ford of Brazil, in the second phase of an expansion and modernization program, probably will buy bolster presses. Orders for the initial phase were placed earlier this year.

One press builder regards the outlook as so favorable that he has, to quote his own words, "been buying steel plate like crazy."

Boeing buys N/C machines . . .

Boeing has ordered 10 machine tools and a welding machine, all of them equipped with Bendix contouring control systems, for its Wichita, Kansas, plant. Part of the Air Force's modernization program, the equipment will replace existing facilities on the B-52H global ballistic missile bomber project.

This $2.5-million order (of which $600,000 will be for Bendix control systems) consists of: two Pratt & Whitney Numeric-Kellers, a Jones & Lamson turret lathe, two contouring Kearney & Trecker Milwaukee-Matics, two Omnimils and two bed-type milling machines from Sundstrand, a Sciaky welder, and a Giddings & Lewis rotary planer.

The new machines will be added to what already is the biggest concentration of numerically-controlled machine tools in the world.

Almost 200 numerical control systems, 63 of them contour-control systems, have been sold by Bendix's Industrial Controls Section. This section is now doing an annual sales volume of nearly $3 million. It recently booked over $1 million in orders in a single month.

Export licenses stymied . . .

Some half dozen to a dozen applications for licenses to ship U S machine tools to Russia still are stymied in the Commerce Department. Virtually all of them are said to be related to automotive tooling programs.

Commerce officials explain that processing "is a lengthy operation" and is proceeding normally; that licensing authorities and technicians are gathering all the necessary information and will pass it along to the inter-agency advisory committee for review before each application finally gets to Secretary Hodges. Pushed for a timetable, Commerce people say that they will not hazard a guess as to when the first of the applications will come up for final decision.

One story has it that the real reason for the delay is that a reorganization of the application review procedure, below the top echelon, is "in the works" and nothing will happen until this matter is settled.

Schools take 10,000 tools . . .

U S vocational schools are taking about 10,000 small general-purpose machine tools a year from government surplus through the program run by the U S Department of Health, Education and Welfare.

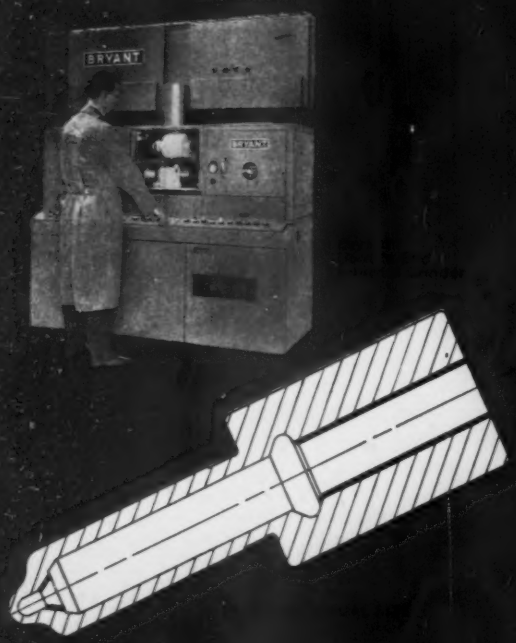
For some time members of the American Machine Tool Distributors Association have been working with State Agencies for Surplus Property and with local school officials to expedite the program. AMTDA's government relations committee made a survey that showed that schools needed and wanted technical advice in selecting tools from surplus lists, in inspecting the selected tools and in making arrangements for acquiring and installing the tools.

BF

CAN YOU TOP THESE 2 GRINDING JOBS?

They're tough. One requires grinding both a straight and a tapered bore in diesel nozzles and similar workpieces at a single chucking. The second requires grinding a wide range of races for miniature and instrument ball bearings. Both are handled efficiently and economically by Bryant high production internal grinders.

All Bryant industry-engineered grinders are proved out by statistical quality control to assure you of predictable day-after-day production quality. Got a tough internal grinding job? Just drop us a line, enclosing specs and production requirements.



SOLUTION to the diesel nozzle job is this new Bryant Double-End Internal Grinder which grinds both a straight and a tapered bore at a single chucking of the workpiece. Two opposed wheel slides and a rotary indexing worktable permit grinding two workpieces simultaneously. Completely automatic, it triples the productivity of conventional machines. And, because this duplex machine cycles automatically, operator simply has to load and unload workparts.

SOLUTION to the grinding of a wide range of miniature and instrument bearing races is the Bryant Model "B" Miniature Centalign® Internal Grinder and its "packaged tooling" for simple, quick job changeover. Available either for ball tracks or for bores, it's the standard machine for miniature bearing production throughout the world. Proved in production lines, it's acknowledged by all major bearing companies as the finest machine available.

BRYANT

Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

CIRCLE 312 READER SERVICE CARD

MATERIALS...

Diamond bearings...

It is likely that a whole new family of bearing materials will come out of surface treatment experiments undertaken recently by England's Rolls-Royce Ltd.

Actually, the Rolls-Royce experiments are an offshoot of accelerated wear tests made at Joseph Lucas Ltd, where fuel contaminated with silica in particle sizes up to 10 microns was fed to a swash-plate pump.

Lucas found that wear rate, instead of increasing with contaminated fuel, was half of that with clean fuel.

Rolls-Royce tests show that load carrying capacity improves greatly and friction diminishes when the sliding surfaces are impregnated with fine diamond powder.

For example, Rolls conducted an endurance run with an impregnated bronze surface sliding on steel. The only lubricant: kerosene. Loading was three times the failing load of conventional lapped surfaces. The result: the coefficient of friction was less than 0.001.

Surfaces were prepared by coating them with diamond powder at the interface. Diamond particle sizes ranged up to 12 microns, and about 0.00015 gram of powder was applied per square inch, at a cost of perhaps a quarter-cent.

Silicon carbide works almost as well as diamond powder and it's much less costly, Rolls found.

Giant electron-beam furnace...

Ingots of specialty steels and of refractory metals — up to 20 in. in diameter and 6 ft long — are now being produced in the largest electron-beam furnace ever built.

Capable of melting 1-million lb of refractory metal a year, the three-story-high furnace was built by, and is operated by Temescal Metal Corp of Berkeley, Calif.

Heat-up is instantaneous — there is no time lag, as with conventional furnaces. Raw crude grades of starting material are heated by bombarding them with a beam of electrons. Moving at high velocities, the electrons hit the metal and are converted to kinetic energy in the form of extremely high heat levels. In addition, melting occurs in a high vacuum, which quickly draws off lower-melting and gaseous impurities.

Primarily designed to produce metals for companies in the atomic energy, missiles, and spacecraft fields, this furnace is a milestone. Only eight years ago, Temescal president Hugh Smith, Jr, built his first small electron gun to melt titanium powder. Since then the company has built 10 or more EB furnaces for production, melting and casting. This furnace, with five times the capacity of its nearest EB competitor, marks Temescal's entry into ingot business.

"Frigistors" – a breakthrough...

Personal air conditioners, complete with humidity control, may be as popular as pocket radios now that Needco Cooling Semiconductors Ltd of Montreal has made a breakthrough in semiconductor metallurgy. It has developed a new thermoelectric device which may revolutionize the heat treatment of exotic metals in a protective atmosphere.

Called "pocket freezers," these tiny coolers can suppress the dew point of air and gases.

For instance, they can keep hydrogen atmospheres dry and simplify brazing problems. Parts leave the furnace bright and clean. No chemicals, cryogenic gases (such as Freon), or moving parts are needed in this thermoelectric drier. Electrons do all the work. Effectiveness down to -80 C has been achieved.

Graphite protected to 2500 F...

Two new boron silicide compounds, plasma-sprayed as a coating, permit graphite parts to operate in oxidizing atmospheres at temperatures to 2500 F. Allis-Chalmers engineers, who developed the process, say spray-coated molybdenum parts are protected to 1800 F. A-C claims its spraying process permits both metals to be used as structural parts in previously forbidden areas, such as air-cooled nuclear reactors.

Patents are still pending on the process, hence very few details are available. However, it is known that A-C uses either tetra-boron silicide or hexa-boron silicide. Coatings are about 0.004 in. thick, and adherence is excellent.

Ductile molybdenum...

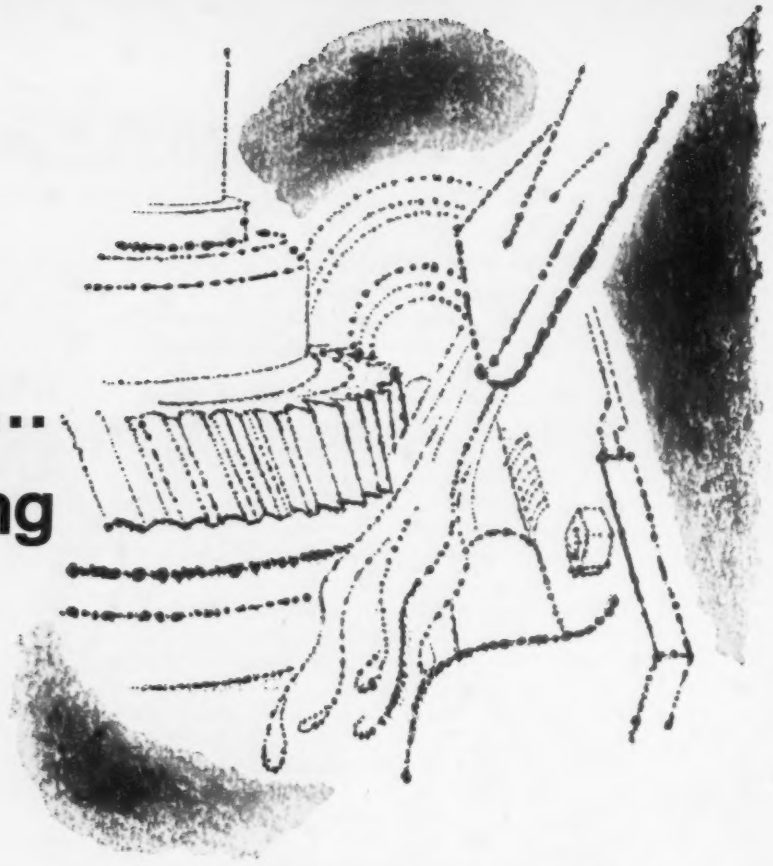
Molybdenum pure enough to be ductile in the as-cast condition is being produced on a pilot plant basis by Oregon Metallurgical Corp, Albany, Ore.

A 100-lb vacuum-arc-cast ingot analyzes less than 20 ppm carbon, less than 20 ppm oxygen, less than 20 ppm nitrogen, and less than 50 ppm sulphur.

Tensile coupons cut from the unworked ingot have 37,000 psi yield strength, 46,000 psi ultimate tensile strength, 3.5% elongation in 4D, and 3.2% reduction in area at room temperature.

The ductile molybdenum is produced by reducing molybdenum sulphide with tin.

Hobbing... Cutting Oils... and Reducing Rejects



Fewer rejects mean lower unit cost. For extremely tough jobs, Sinclair Ordnance heavy-duty type cutting oils have earned the reputation—in plant after plant—for increasing production by reducing rejects. Ordnance Oils assure excellent finish, cooler parts and extended tool life. Next time you have a threading, broaching, hobbing or other difficult metal-working operation, show management how you saved money and further reduced rejects with Sinclair Ordnance Cutting Oils.

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WHAT'S AHEAD... in Metalworking

TRENDS

Summer slump should be short and mild...

Metalworking activity appears to be tapering off slightly now that the summer months are here. The traditional declines, however, do not seem to be as steep as in previous years.

Steel production is down somewhat, mainly because of slower automotive ordering, but observers feel that the slump will not be as bad as in previous years. Some mills are now anticipating a big boost in tonnage for 1962 car production—perhaps 50% or more over current rates.

Farm machinery builders, after a fairly good spring, are experiencing a decline in sales. Business now is running about 10% below last year. And scattered layoffs are reported in some tractor plants.

Construction machinery builders report just about the same conditions. Business has been quiet all year long, and currently is down about 10% from 1960 levels.

Tool and die makers are optimistic about 1963 automotive ordering because of Detroit's recent experiences with foreign tooling purchases. (Ford has had to bring the dies it was building in England and Germany back to the United States because of production delays and higher-than-expected costs.) Current business, however, remains slow.

Tool and die shops connected closely to the aircraft industry report business off about 20% from this time last year. Most of these shops were depending upon the B-70 program to give a boost to their business.

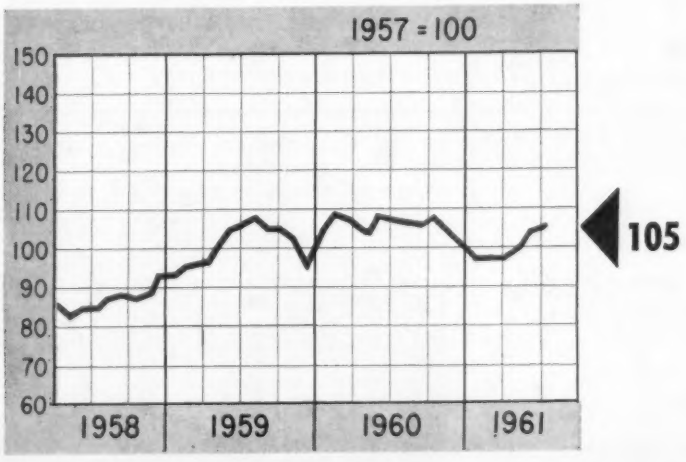
Welding shops report slow and spotty business. Volume is down sharply for many concerns. The small orders that keep some shops fairly busy on a spot basis are always marked "Rush," forcing the welding shop operators to schedule overtime work and reduced work weeks in the same month. Outlook is for a pickup in the fall, with a possibility of end-of-the-year results coming up to those of 1960.

Sheetmetal fabricators are operating about on a par with last year. This has been true ever since the pickup in their operations around the beginning of 1961, and nothing is expected to change during the rest of the year.

The electrical machinery industry continues to work off backlogs, but a pickup in ordering is expected during the fourth quarter of 1961. Expectations are that the industry will show a dollar-volume gain of about 5% over last year, but last year wasn't too good a year, according to many industry spokesmen.

Drop forgers are running slightly below the pace of 1960; some shops report business off as much as 10%. Those forgers tied closely to the machine tool industry are feeling the decline more than those who are more diversified.

Materials handling equipment manufacturers report an increase of nearly 27 points over orders reported the previous month. The monthly bookings index of the Material Handling Institute rose to 136.47 (1954=100). This sharp upturn in business follows a 20% drop in orders in the previous month.

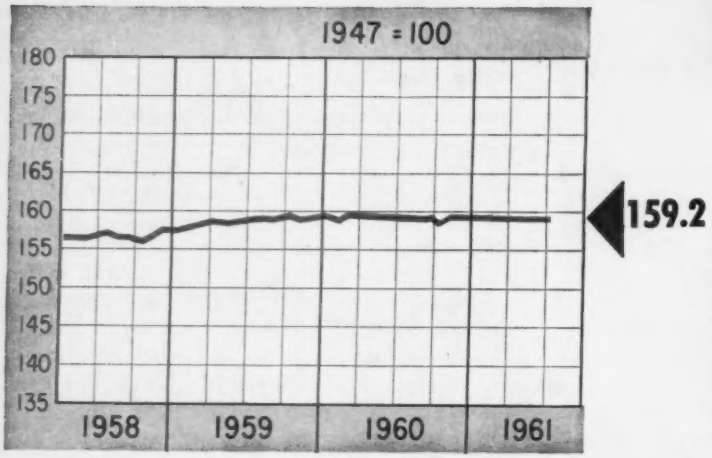


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUN Estimated	MAY Preliminary	APR Revised	JUN Year Ago
Total Index	**105**	**103**	**99**	**107**
Machinery		**101**	**98**	**104**
Electrical Machinery		**112**	**109**	**115**
Autos		**104**	**98**	**120**
Other Transportation		**90**	**88**	**93**
Other Metalworking		**108**	**102**	**111**

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUN Estimated	MAY Preliminary	APR Revised	JUN Year Ago
Total Index	**159.2**	**159.3**	**159.3**	**159.4**
Metalworking Machinery	**194.6**	**194.7**	**192.2**	
Other Machinery exc. Electrical	**174.0**	**173.9**	**172.5**	
Electrical Machinery	**156.0**	**156.0**	**160.2**	
Fabricated Metal Products	**147.1**	**147.1**	**147.7**	

Inventory buildup strengthens business picture...

Among all the diverse factors affecting the business outlook, the inventory situation is undoubtedly of great importance. For example, when manufacturers and tradesmen decided to trim their inventories last winter, the rate of total business activity — GNP — took a $4.5 billion shellacking between December 31st of last year and the end of this March. Business sentiment then shifted and inventories were accumulated to the tune of a $1.5-billion rate between the end of March and the end of June. By any standards, shifts like those are large, even in our half trillion dollar economy.

In coming months, inventories will be a distinct bright spot on the business scene. During the third quarter now beginning, total trade and factory inventories will be accumulated at a rate of $1.5 billion; in the fourth quarter the inventory gain will be twice that much.

The hard-hit durable goods industries were the ones who cut inventories to the bone during the winter. Manufacturers of both electrical and non-electrical machinery trimmed their stocks mercilessly each month since last year in an effort to bring their inventory-to-sales ratios down to better levels. The auto industry has also cut stocks heavily, while lumber and furniture manufacturers and the stone, clay and glass industry have made more modest cuts in inventories.

By contrast, soft goods manufacturers and wholesalers have built up their stocks. These products are normally less affected by general swings of business activity than hard goods, and manufacturers and distributors can rely on fairly steadily growing demand through the thick and thin of recessions.

Thus it has been non-durable-goods producers who have boosted business so far this year by adding to their stocks.

The business picture for the second half of this year is brightened by the fact that durable goods inventories should soon start growing in response to durable sales and new orders.

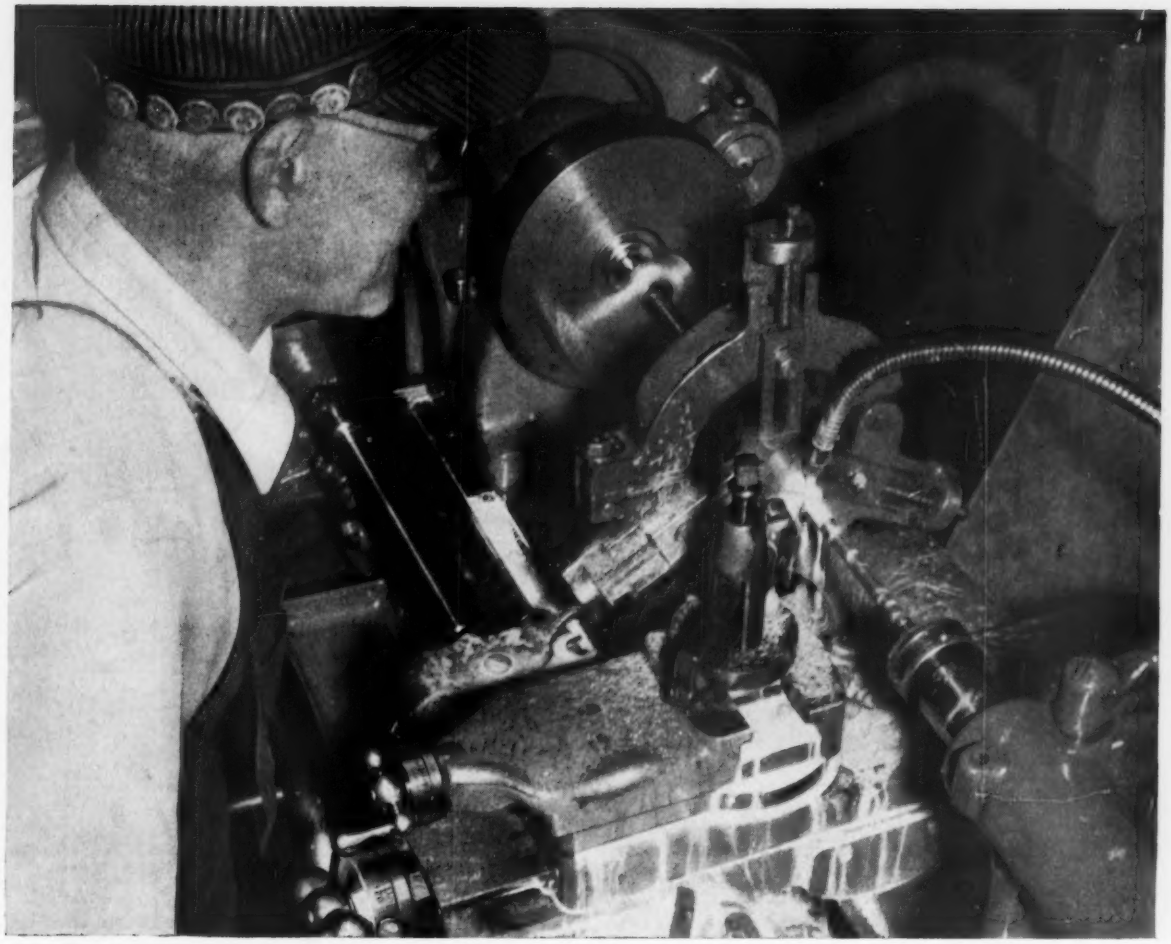
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	155.5	154.9	149.3
Steel ingot production (thousand tons)	1,779	1,925	1,203
Electric power output (million Kilowatt hours	14,133	15,183	13,408
Production of automobiles	86,281	125,297	89,769
Engineering construction awards (*Eng. News-Record*—thousands)	$86,372	$77,677	$98,451

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	274	300	300
Vacuum cleaners sales (thousands of units)	265	350	278
Washers sales (thousands of units	164	240	176
Household electric ranges sales (thousands of units)	80	81	68
Radio production (thousands of units)	739	409	1,290
Television production (thousands of units)	409	394	425
Gear sales index (1947-49=100)	246.2	299.3	249.2
Foundry equipment new orders index (shipments, 1947-49=100)	115.2	99.1	97.9

* Seasonally adjusted



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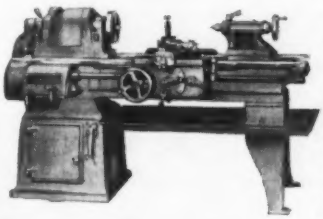

Prices of South Bend 16" Engine Lathes start at $2591 f.o.b. factory.

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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

New Premium on Efficiency

Metalworking is on its way up. After idling around the recession low of 95 for several months, the *AM/MM* Production Index has climbed sharply to 105 during the past ninety days.

There is hardly an economist or manufacturer who does not feel that 1962 will be a good year. Many business men believe that we are in the initial phase of a two-year or three-year cycle of expanding operations.

But even if the economic climate ahead should be sunny and bracing, management is going to have its troubles.

What are the troubles? First of all, prices. The situation in the retail field is shaky. What with discount houses, chain stores and massive shopping centers, there is no such thing as a firm price. When you buy a major item, you dicker over the price and save yourself some money.

The situation in industry . . .

is not much better. Price cutting has been nourished by too much capacity and too little demand. It may cure itself in time. Even so, there are many reasons why increases in prices, no matter how justifiable, will be hard to establish.

Foreign competition, for one thing, is breathing down the necks of U S manufacturers. It thrives on price. Beyond that, the Kennedy administration seems bent on using every device it can think of to beat prices down as one means of fighting inflation. As an overriding consideration, the sheer force of competing for existing business will act as a deterrent to price advances.

All of this might not be so bad if costs do not go up. But let's not bemuse ourselves with the false thought that the pay package of the worker, with fringe benefits added to hourly rates, is going to stay where it is.

Does any sane person think that Walter Reuther will come out of his automotive labor negotiations without something more for his union members? The upward-and-onward pattern will be set once again at Detroit.

Metalworking management, as it heads into a cycle of growing business, will thus be confronted by an insecure price structure and by higher labor costs. To avoid getting caught in an unprofitable and painful squeeze, it will be forced to put a new premium on efficiency.

It has recourse . . .

mainly to one powerful device—increased productivity. But the truth is that management has made a poor showing for a long time in productivity compared with our friends in other countries.

If you take 1953 as 100 for the base, output per manhour in U S manufacturing had risen only to 115 by 1960. In the same time span, it rose to 129 in the United Kingdom, to 153 in West Germany, to 154 in France, to 158 in Italy, and to 171 in Japan.

These figures should be no surprise. Other nations of the Free World have been going through an industrial revolution. They have installed new processes and new equipment like mad. And their governments have given their manufacturers important aid, partly by fast tax writeoffs.

We have been content . . .

meanwhile to coast along with our production equipment getting progressively older in age and only a fraction of our manufacturers taking advantages of the new techniques that are crying out to be used.

Yes, it is high time that we put a new premium on efficiency. For if we do not, the period ahead may well turn into one of profitless prosperity. That certainly is the last thing than any of us, including Washington, wants.

Burnham Finney **EDITOR**

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VOL 105, NO 15 **American Machinist** / *Metalworking Manufacturing* JULY 24, 1961

WINDING PLASTICS INTO SHAPES

1. Filament winding does many jobs

Cheap, strong, light, and possessing many other good qualities, filament-wound structures are finding new uses almost daily. Here is a digest of the general picture presented to the ASME Aviation Conference

	Filament Winding		Titanium	Steel
	Type E Glass	High Modulus Glass		
Density (lb per cu in.)	0.075	0.081	0.163	0.285
Tensile Yield Strength psi	120,000 Undirectional strength 220,000	115,000	150,000	220,000
Strength-Weight Ratio	160×10^4	142×10^4	92×10^4	78×10^4
Modulus of Elasticity	5.5×10^6	9.0×10^6	16.5×10^6	30×10^6
Elongation %	2.18	1.28	0.91	0.73

Filament winding is among the newer ways to make reinforced-plastic parts, but it is gaining popularity in the aerospace industry and may soon work its way into more common applications. Its supporters point to its low cost and especially to its high strength-to-weight ratio as the principal advantages.

Present tensile yield strengths are better than 110,000 psi, and "possibly within the next five years, a composite stress level of 300,000 psi can be realized," according to an ASME paper presented by R Gorcey, J Glyman, and E Green of Rocketdyne (a Division of North American Aviation, Inc), Canoga Park, Calif. Along with this, they forecast high-strength filament material with melting temperatures as high as 2500 F.

Higher strengths to come

Eventually, with the help of carbon whiskers, filament winding may even reach "stress levels of 850,000 psi with a modulus of elasticity of 85×10^6 psi and density of 0.061 lb per cu in. This would mean a strength-to-density ratio of 1400×10^4, which is 8.7 times the highest present value."

Basically, the filament-winding process is exactly what the name implies, the fabrication of structural shapes by winding filaments. In order to provide structural integrity, the filaments are held together by a plastic material.

In practice, the filaments and plastic material vary, depending on the application; however, for the most part, glass filaments are used with epoxy resins. It is this combination of materials that produces the strongest structures on a strength-to-weight basis.

The process consists of impregnating the strand of reinforcing material and winding it either upon a basic structure for additional reinforcement, or upon a mandrel that is subsequently removed. After the winding is complete, the entire part is placed in an oven for cure.

Until recently, the common practice has been "wet winding"— impregnating the strand immediately prior to application. However, pre-impregnated material has now become available, with the result that almost any resin system can be employed, and the operation has been cleaned up considerably.

There are three basic systems for winding filaments: circumferential winding, helical winding, and longitudinal winding. With these three systems, either alone or in combination, the filaments can be placed so that they are used most effectively, and any ratio of hoop to longitudinal stresses in a part can be balanced out properly.

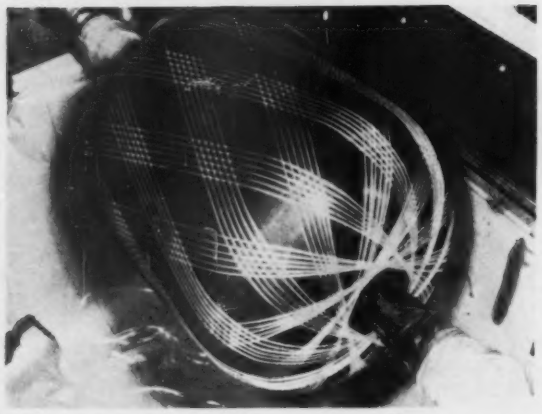
Many important advantages

The outstanding advantage of filament-wound structures, according to the Rocketdyne engineers, is their high strength-to-weight ratio—much higher than those of either high-strength steel or titanium. This means that filament-wound parts can be lighter, which is especially important in flight applications such as rocket-engine components.

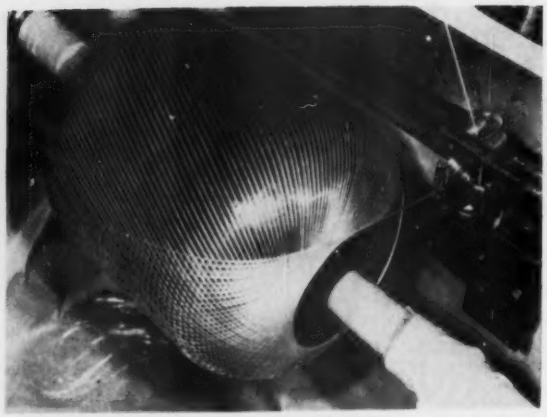
Low cost is another advantage—if the comparison is made with high strength-to-density metals. Filament-wound parts can be made in some instances for 10% of the cost of the titanium parts. The cost of large-sized filament-wound parts might be as little as 20% of the cost of equivalent high-strength-steel parts.

On the other hand, when a comparison is made with materials such as low-carbon steel, it is very diffi-

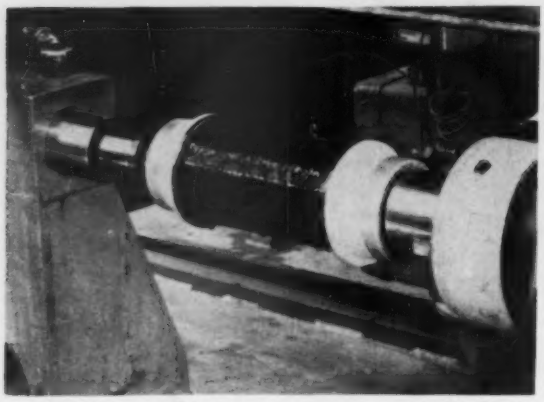
Winding plastics into shapes . . .



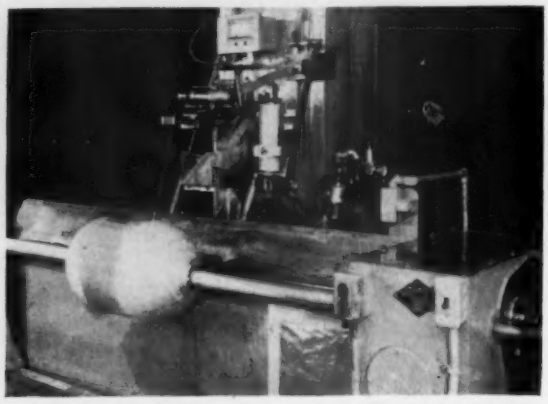
Helical pattern is generated on winding machine that rotates the part and traverses the filament feed back and forth



Longitudinal winding will be overlaid with circumferential winding, as filament strength is high along axis, low in shear



Circumferential winding machine can make cylindrical parts with high hoop strength; longitudinal material, hand placed between the windings, gives longitudinal strength



Small helical winding machine can make composite winding —both helical and circumferential; gives high hoop and longitudinal strength, as well as integral heads

cult for filament-wound structures to show a cost advantage. In certain cases, however, their cost is equal or only slightly higher.

In another area—tooling costs—filament winding is given a definite edge. The tooling required here is usually only a fraction of the cost of tooling for high strength-to-density metals. It even costs less than the tooling for low-carbon-steel parts, although by only a small amount. Further, the same tooling can produce filament-wound parts with different wall thicknesses, if desired.

In addition to their outstanding strength-to-weight ratios, filament-wound structures possess a number of other desirable characteristics. Corrosion resistance is extremely good; the same resins are often applied to metal parts for corrosion resistance.

Thermal conductivity is so low that case insulation on solid-propellant rockets can be reduced, or possibly eliminated—an additional savings in weight. High dielectric properties have already put filament winding in a position where it almost dominates the radome field.

Notch sensitivity (caused in metal structures by scratches, poor welds, or mismatched welds) simply doesn't exist in filament-wound structures. Nor do these parts shatter on failure.

No limitations on size

Furthermore, there is no real size limitation on the parts that can be made by filament winding. At present there are machines that can fabricate parts up to 15 ft in diameter and 65 ft long.

This is a good deal larger than the biggest parts made from high strength-to-density metals, say the Rocketdyne engineers. The reason: these metals have to be heat treated, and heat-treating facilities of this size are not available.

Reproducibility and reliability of filament winding, already high, will be further improved by numerical control. Rocketdyne has already built a digital-tape-controlled machine that will eliminate operator variables and assure identical parts.

The possible applications visualized by the authors of this paper are many and varied. In addition to rocket-engine components, they include nose cones, airframe structures, and pressure vessels of all kinds.

Among everyday applications are water heaters, softeners, pipe fittings, elbows, and ducts. There is a large potential in shipping containers, as well as tanks for oil-field storage and transport.

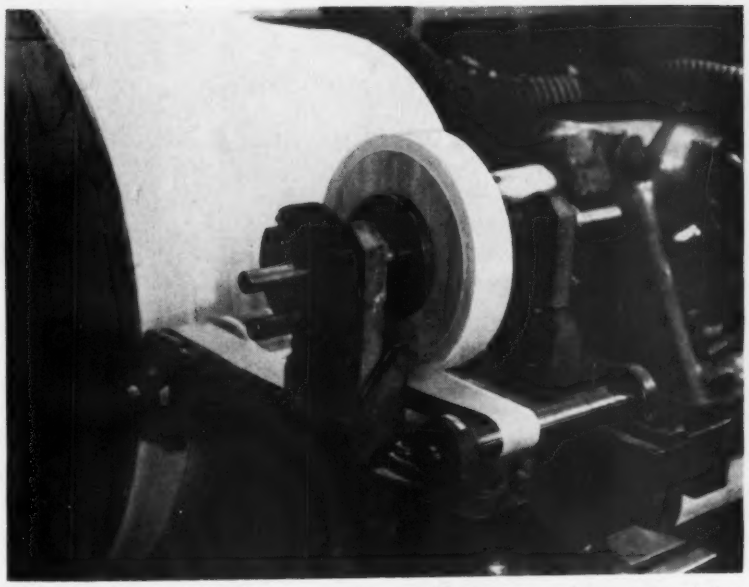
The field of sports is represented with fishing rods, golf clubs, and boat masts and antenna. And an important feature of the process is that the materials are in plentiful supply. There is no danger of shortage for either commercial or military applications, even in time of crisis. •

WINDING PLASTICS INTO SHAPES

2. Lap winding is best for cones

Winding techniques for reinforced plastics can produce accurate, lightweight parts inexpensively. Here are the operating details — tooling, fixtures, methods — for one of these techniques

By John S Hammond,
Micarta Division,
Westinghouse Electric Corporation,
Hampton, S C



Winding attachment on lathe's compound rest guides impregnated tape onto rotating mandrel. Steam-heated roller, driven by pneumatic cylinder, presses tape into place

Lap winding with tape reinforcement—a combination of the filament-winding and convolute-tube-rolling processes—was developed as an improved fabrication technique for missile heat shields. It is especially suitable for large cone-shaped or ogive-shaped (flared) structures.

Filament winding doesn't work so well on these shapes, because the filaments can't be anchored and tend to slip down to the smaller-diameter end as they are wound. Even with lap winding, slippage can be a problem, but the flat tapes make it an easier problem to solve.

Currently, conical sections are being wound from 27 to 50 in. in diameter, with wall thicknesses ranging from ½ to ¾ in. The walls have uniform thickness and uniform density, but the thickness can be changed, if desired, by varying the width of tape.

Three steps make heat shield

In making a missile heat shield, the process includes three major operations:

- Winding the impregnated fabric strips circumferentially on a mandrel, at specified tension and pressure,
- Curing at atmospheric pressure under infrared heaters,
- Machining the outside surface to meet dimensional standards.

Two previous methods of making large conical sections: molding in costly matched metal tooling, and bag molding from hand layups. Other production methods include filament winding and edge winding—as well as machining to the desired shape from thick laminate that has been fabricated to the approximate shape.

Each of these methods, however, has serious deficiencies, such as expensive tooling and/or production equipment, slow production rates, and excessive loss of expensive materials of construction. This does not mean that lap winding has no drawbacks, but it definitely improves on these conditions.

Any machine that can rotate the mandrel and feed the winding attachment longitudinally along the mandrel can do the work—an engine lathe or a boring mill, for example. The reinforcing tape can be any of a variety of woven and non-woven materials, including leached glass, quartz, graphite, and nylon fabrics. However, since this project has emphasized heat shields, most of the work has been with impregnated glass and asbestos fabrics.

All types of resin systems are usable with the lap-winding technique (In the present phase, it is a B-stage diallyl phthalate system). Previous work centered around melamine and phenolic resins.

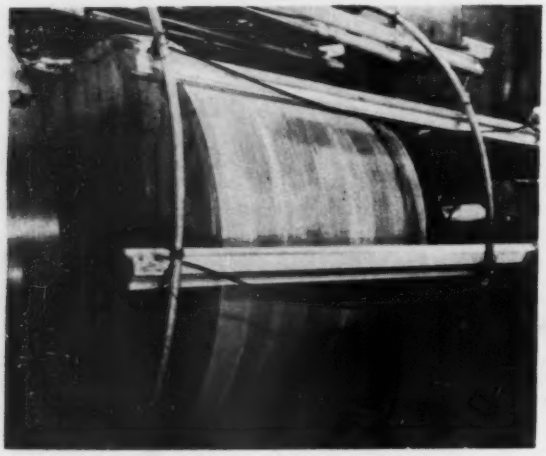
In a typical operation, the winding is started on a cylindrical section of the mandrel. As the mandrel rotates, it draws the tape from the feed roll on the winding attachment and pulls it through a tension device and then over a steam-heated roller that presses it against the growing lap-wound structure.

At the same time, the winding attachment (mounted on the compound rest) is moved longitudinally by the automatic machine feed. Feed rate is determined by the width and thickness of the tape and the angle of inclination of the winding material to the axis. The object is to make a shell only thick enough to require some machining all over to meet specified dimensions.

Slope affects tape width

When the slope of the mandrel increases and the wall thickness remains constant, narrower tapes hold down the amount of treated material employed (the excess would only have to be machined off later). Along with this change, the winding tension and pressure also have to be reduced to maintain uniform density.

Tension changes are made by either reducing the friction-brake pressure or decreasing the vacuum drag on the material, depending on which tensioning method is em-



Infrared heaters cure lap-wound part on same machine that did winding (cover is placed on frame for heating). Final machining of surface is also performed here

Missile heat shield, made of Micarta HT-5478 treated material, has uniform, high hoop strength; 100% orientation of wound fibers gives the surface uniform erosion

ployed. A tension of 8 to 15 lb per inch of width is usually the desired range for low-density sections.

Winding contact pressure is changed by adjusting the pneumatic cylinder that forces the steam-heated roller against the winding material. (An alternate design might employ springs instead of a pneumatic cylinder to maintain this pressure.)

Other variables in the lap-winding techniques are speed of rotation and temperature of pressure roll. Usually, the temperature is held constant, and the speed of rotation is varied according to the greenness or flow of the material being used.

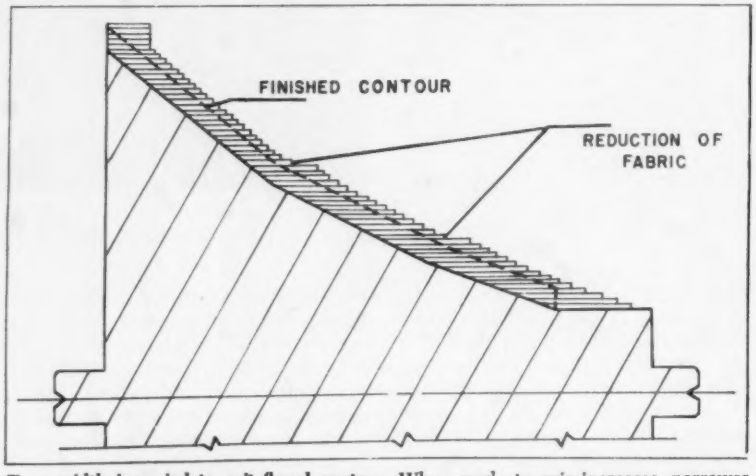
Excessive roll temperatures can cause material slippage during winding, because the heat retained in previously wound material keeps it in a softened condition. This excess heat can be removed by a small airflow cooler, mounted to follow the winding attachment.

Equipment needs are few

Aside from the lathe, the only major item of equipment is the winding attachment. Of course, each different shape to be fabricated also requires its own mandrel.

Mounted on the compound rest, the winding attachment carries a roll of the tape being wound, the tension device, and the pressure roll. Tapes are normally prepared in advance by impregnating the fabric, slitting it to the desired widths, and rolling the strips on wooden cores. However, the winding attachment could be adapted to carry a wet-resin dip for treating and winding in a continuous operation.

The center line of the pressure roll is aligned with the center line of the lathe, and the roll is heated with steam. Although this is the most costly part of the attachment, it is a relative inexpensive item.



Tape width is varied to suit flared contour. When angle to axis increases, narrower tape is fed onto mandrel to avoid waste and reduce amount of machining needed later

The design of the winding attachment was kept as simple as possible in order to determine the most efficient mode of operation. To date, the only components added have been a tension-measuring device and a hot-roll scraper.

The mandrel serves three functions and goes through the entire process. It establishes the finished inside dimensions of the part during the lap-winding phase. It supports the wound structure during curing. And it acts as a machining fixture during the turning operation.

Constructed of rock maple wood for strength, it has a ¾-in.-thick lap-wound phenolic-glass surface. This gives it a hard surface with low shrinkage characteristics and good heat resistance during curing.

Eight heaters cure part

As this particular section was cured at atmospheric pressure, it required only a bank of eight Chromolox heaters (20 kw total rating) supported about the circumference. The mandrel and windings were rotated slowly under this bank until cured.

The final machining was performed by a very simple form of contour turning—a rigidly mounted templet, followed by a dial indicator. Nevertheless, the method has produced excellent results and has met the tolerance of ±0.010 in., specified on all dimensions. •

Now... FLAME CUTTING with N/C

Completely automatic flame cutting —from lighting the preheat flame all the way through to cutting out a complex shape and turning off the gas — is the result Air Reduction Sales Co gets from its new Tape-O-Graph. A General Electric Mark Century numerical control system tells the flame cutter exactly what to do each second it is operating.

The punched-tape input data not only tells cutting torches how to navigate any complex shape—it also ignites flames, controls gas supply, starts and stops the machine, maintains constant cutting speed, and even continually shifts torch position to compensate for kerf width—thereby giving any part an accuracy of ± 1/64 in. over the machine's entire 22 by 48-ft cutting area.

Basically, Airco's new machine is a bridge-type flame cutter, driven by a rack and pinion, over precision rails through two synchronized ½-hp dc gearmotors. Up to four cutting torches are driven across the bridge on a precision leadscrew.

Airco plans to market the machine with heads which — by automatic command from the Mark Century — allow for flame width. Thus, actual part dimensions can be fed into the machine. This compensation is precise, whether the torch is cutting a straight line, slope, or radius.

Also, the torches are kept at proper height by four rollers which ride on the plate, and the torch automatically adjusts for any plate irregularities.

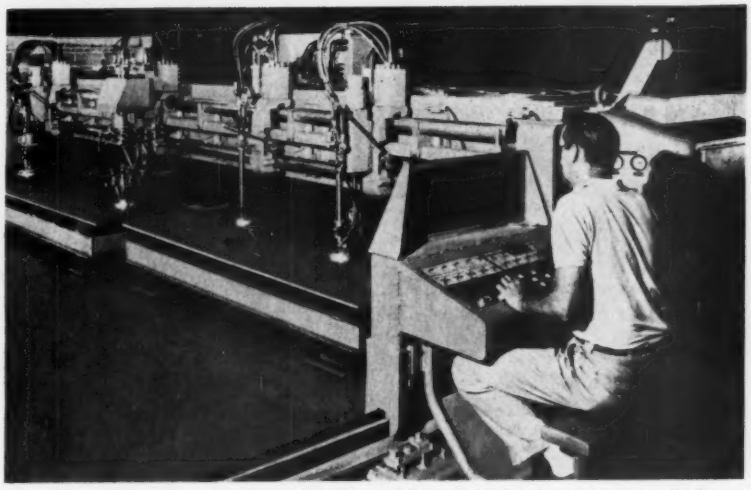
To make any new part on the machine, five steps are necessary: First, designers make a part sketch, which is made into an engineering drawing.

Next, a programmer takes the drawing and writes down the starting and stopping points for each separate line around the part. If a portion of an arc is to be cut, he must put in the radius and starting angle condition. He also lists auxiliary functions and selects desired cutting speed (2 to 35 ipm range, with 150 ipm rapid traverse).

The program is then typed on a Flexowriter and reproduced on standard punched tape.

Finally, this tape is read into the control, which starts the flames and then computes all positioning commands and path velocities as they are needed.

All control equipment, except the operator's station, is enclosed in a sealed, air-conditioned cabinet. •



N/C flame cutter can have a special head (2nd from left) that has 3 torches which cut edges—along any contour—for double-bevel joints with a flat nose. Mirror images are cut by prototype machine because leadscrew has half LH, half RH threads, but continuous leadscrew is available. Operator, riding with machine, can over-ride tape commands

Six continuous-path tape-controlled lathes go through shop at one time

The only place in the free world where you can see six continuous-path tape-controlled lathes being built at the same time is at the LeBlond Machine Tool Co in Cincinnati. In LeBlond's shop today six 20-hp Tape-Turn lathes (2013 and 2516 sizes) are being run off to better-than-toolroom alignments.

The Tape-Turn models shown have 30 or 90 spindle speeds from 22 to 1000 rpm and motor speed ratios of 4-to-1 or 20-to-1. The 4025 size is available with up to 75 hp. (*AM/MM* —Feb 6 '61, p125)

All of these new lathes are controlled by General Electric Mark Century continuous-path controls. Completely interchangeable 3-,4-, or 6- station turrets accept preset tooling. Twelve-position indexing of the turret allows tools to be positioned for machining on workpieces of almost any shape. •

How to automate a chucker

Chucking or bar automatics equipped with suitable loading devices can easily be integrated into automated production and assembly lines. Thus the lines achieve both production flexibility and highly reliable performance. Here's one way to do it.

The problem . . .

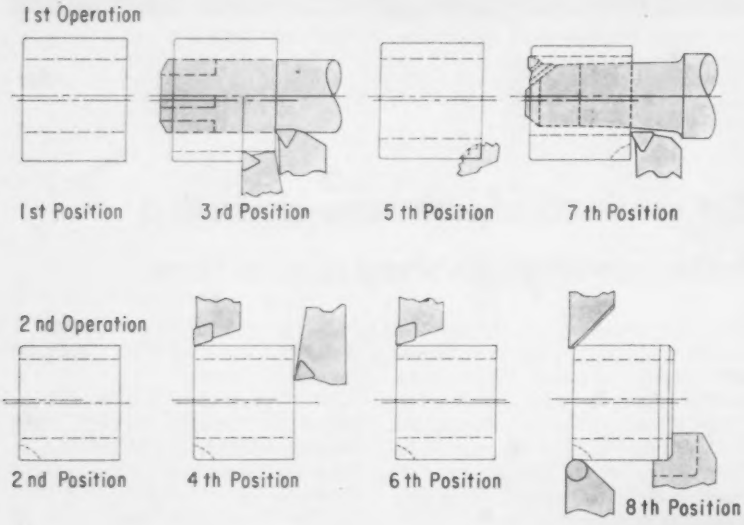
Considerable time was wasted in removing this pearlitic malleable casting from an automatic chucking machine in order to mill a locating slot. Then, after the slot was cut, the piece was returned to the chucker for completion.

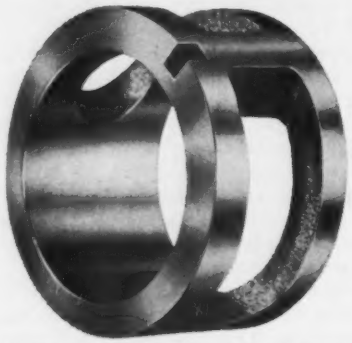
Operator fatigue not only caused production problems but handling delays, and a substantial back-up stock of milled parts had to be maintained for final machining on the chucker. Adding a second operator to help with the loading increased the cost per piece.

. . . and the solution

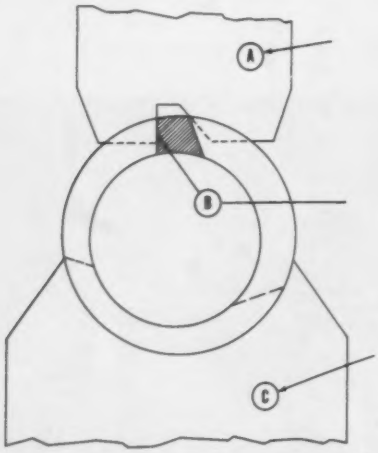
The problem was solved by retooling a National Acme 6-in. RPA 8-spindle chucker, arranged for double indexing—plus spindle stopping and spindle positioning.

Now, the slot is milled during the first operation cycle of the machine—then the piece is completed. The setup calls for magazine loading, spindle loading, extraction, automatic part turn-over, reloading, and discharge of the irregularly shaped finished part into a chute. Here is how the job is done . . .

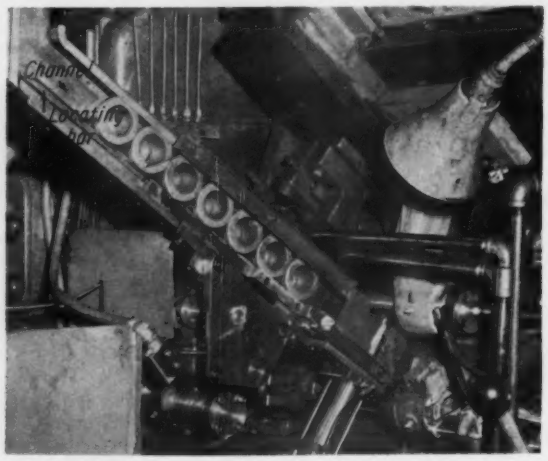




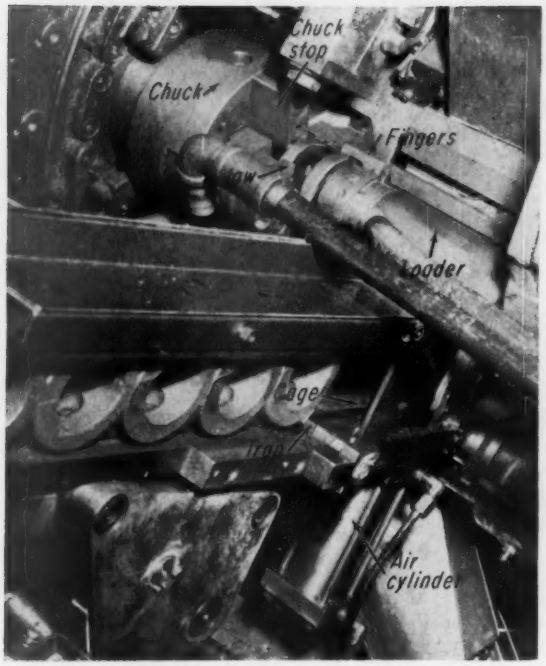
1. With this tooling layout, the first machining operation (including milling the slot) is completed in odd-numbered positions. Casting is then rotated end for end and finished as secondary operations are completed in even-numbered positions. All cutting tools are carbide except the milling cutter



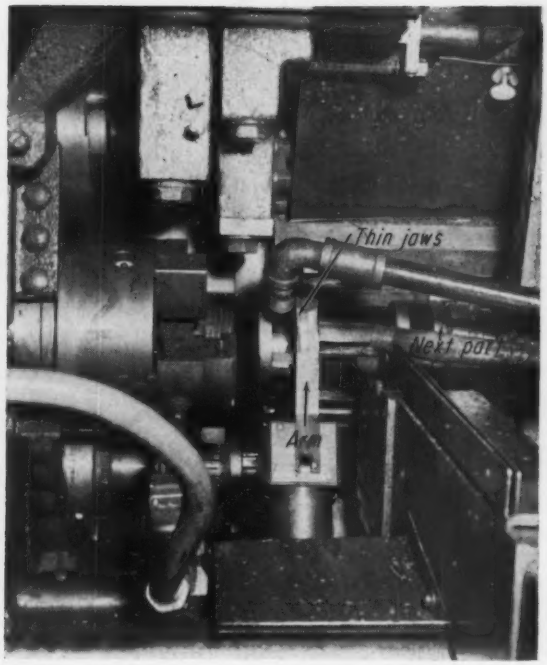
2. Chucking for the first operation is done with two eccentric jaws. Movable jaw is positively loaded against face of web, forcing casting against fixed jaw. Precise positioning is essential to permit accurate slotting



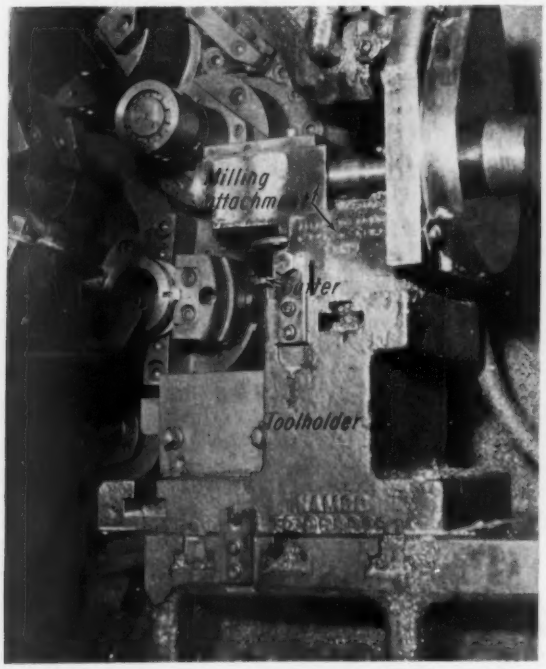
3. Magazine-loader contains orientation bar (in channel) which uses slot in casting to limit part insertion to only one position. Part slides down the guide to positive stop; is raised to spindle position by air cylinder



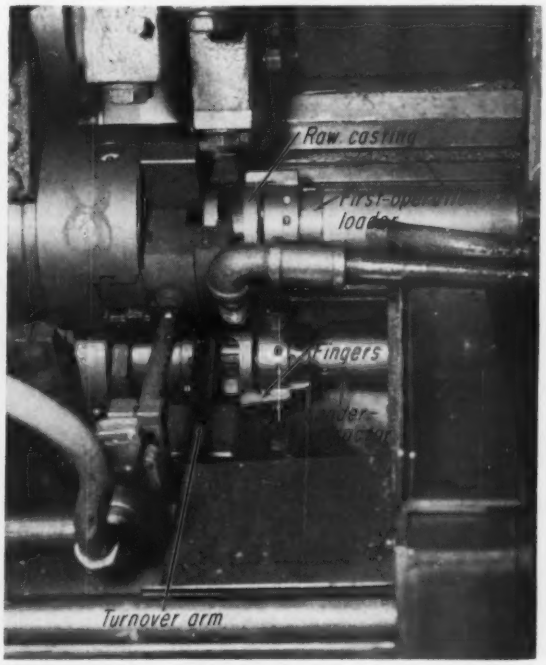
4. For automatic loading, gravity holds part against trap. After machine indexes, trap permits one casting to slide into loading cage. Air cylinder raises part to center line of spindle and loader. Fingers grip part and insert it into open chuck. With spindle positioned, movable chuck jaw wraps around "bridge" on part after spindle has been stopped and positioned automatically. Then loading fingers open, loader moves back, and machine is ready to index



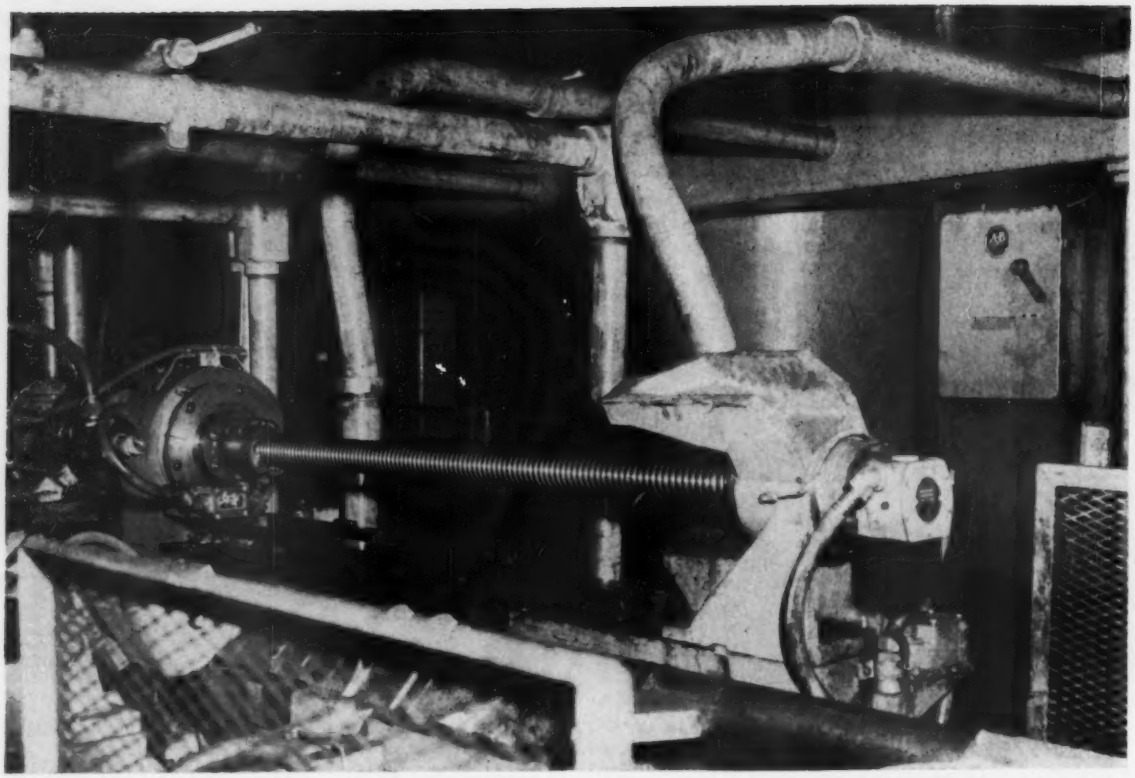
5. For unloading, two thin jaws on arm grasp part and arm retracts to remove piece from chuck. First-operation loader holds next piece ready to insert in chuck jaws



6. Milling attachment is mounted on a double-deck tool holder in the fifth spindle position. Cutter moves into and mills slot on part after spindle has been stopped and positioned



7. For second operations, loader-extractor grips part with fingers and pushes it on mandrel. Driving and locating key on mandrel adapter plate engages previously milled slot. Both transfer-turnover arm and loader move away from part, allowing it to be indexed to next work spindle. Loader-extractor removes part from mandrel when secondary operations are complete and drops it into chute. Meanwhile, first-operation loader has readied a new part in chuck above



Recirculating ball screw moves transfer bar back and forth to index engine blocks from station to station. Screw rotates under motor power; nut actually moves. Screw has 48-in. working length, 2¼-in. diameter

The case for mechanical transfer

Transfer is purely mechanical on Cadillac's 102-foot-long Baush engine block machining line, which began as an experiment to compare hydraulic and mechanical transfer, and is today the most trouble-free line in the plant

By Charles Emerson, Detroit editor

Is strictly mechanical transfer the best way to move parts through a long machining line? Cadillac Motor Car Co, after experimenting with it on part of its main engine block machining line, is beginning to think so—even though company engineers admit it has its drawbacks.

Traditionally, a workpiece as heavy as a V-8 engine block has been shoved along rails through a machining line by hydraulic power. This setup is not only flexible but provides great reserve power, and can slip if there is an obstruction.

Most machines in the Cadillac lineup are hydraulic, but mechanical transfer is a feature of a 102-foot-long Baush unit that mills an oil filter pad, drills and taps holes in the crankcase face, and does a few other machining chores that are easily handled while the block is on its side.

Mechanical transfer has chalked up some advantages, and some disadvantages. On the plus side: less downtime, less maintenance, easier repair when something does go wrong. On the minus side: it takes up a lot of floor space, and many stations are idle.

The Baush unit started out as an experiment—not that there hadn't been mechanically powered machines before, but Cadillac wanted to see how this kind of unit would work out in practice, over a long period of time. The results: excellent.

Although Cadillac has no detailed figures to prove this method's advantages in dollars and cents, neither is there any doubt that there has been less trouble and less maintenance expense than with any comparable unit in the shop.

The machine has run smoothly since it was first installed, and even then it required no more than normal adjustment and checkout.

How it works

The 25-station unit was built to incorporate two identical Saginaw Steering Gear recirculating ball screws, which convert electric-motor power into longitudinal motion to index the blocks 48 inches per stroke.

Each ball screw serves half the machine, moving fairly conventional transfer bars which have protruding dogs that grip the engine block, front and rear.

At each stroke, a small air cylinder rotates the bar 35 degrees, so as to make the dogs clear the work while the bar runs back (upstream) to extended position. The cylinder then drops the bar to normal angle, pull-

ing the blocks along one index length.

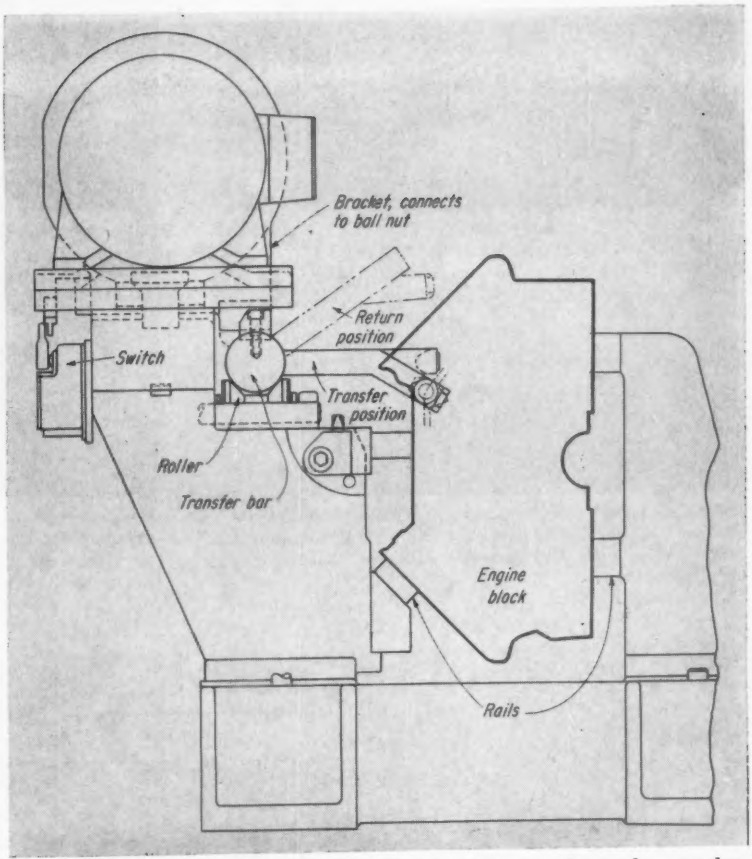
Prime mover is an electric motor fitted with a plug-in switch that changes the motor field, thus reducing speed at both ends of the stroke, and preventing overshooting.

As the blocks stop at their new stations, two pins enter manufacturing holes in each block for positive location. The pins and clamps which hold the parts, incidentally, are powered by the only hydraulics in the machine—a central system operated by air pressure through an air accumulator.

Ball screws rotate at 1200 rpm (except for slow final speed) and the ½-in.-pitch ball nut traverses at 50 fpm. Thus the cycle time for transfer is a shade over 10 seconds.

All cutting tools are driven by strictly mechanical means. Leadscrews in each station advance the tools, while overrunning slip clutches act as safeties in case there is unusual resistance (such as broken tools or an improperly located block).

Cadillac manufacturing engineers say that mechanical feed has saved a considerable amount of bearing wear in the heads—because the spindles rotate only when the heads feed, not all the time.



Ball nut connects to round transfer bar, which rides V-shaped rollers and carries dogs that grip engine blocks. Limit switches control stroke length and interlock all controls to insure proper sequence

Handling engine blocks

Engine blocks enter the Baush machine on a roller conveyor (from the previous machining unit in the line.) First job is handled by a trunnion turnover machine which picks up the block and rotates it 90 degrees, then sets it down again on rails which go completely through the machine. This orients the block on its side — with the crankcase vertical. Then horizontal spindles at work stations can drill and tap holes in the required pattern.

This orientation points up one of the faults of mechanical feed: With the block lined up this way, there is little machining to do on the side opposite the crankcase face (only drilling of an oil gallery hole, for example).

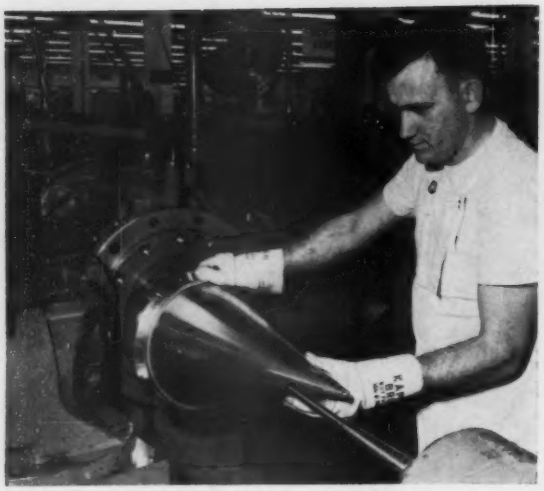
This lack of work on one side of the line, while it allows placement of the ball screw, motor, nut and supplementary gear in a readily accessible place (high alongside the transfer rails), also means that the two feed units interfere with machining on that side of the rails —unless the feed units are located under the rails or are placed high overhead.

Thus the mechanical arrangement can waste floor space, and it idles station on one side of the machine.

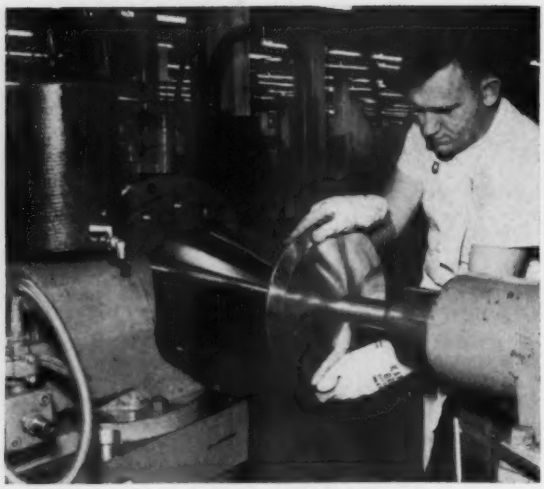
Bushing and drill (left) feed mechanically at different angles; meet at work surface. Drill spindle thus clears bushing. Transfer bar is in foreground, with dog at right

However, the Cadillac people are pretty much in agreement that the machine requires so little maintenance, repair, and adjustment that it has probably justified the extra space and high original cost.

One repair job that does occur frequently, however, is screw replacement. Even though the screws are hardened, they must be replaced frequently because wear in the screw contours can affect part positioning — might eventually prevent location pins from locking in place. Even so, with the transfer unit in its high location, such replacement is comparatively easy. •



Shear-forming of this sharp-pointed missile nose cone in a Floturn lathe was made possible by forming a dimple in the center of the 15-in. OD cupped blank with the point of the mandrel



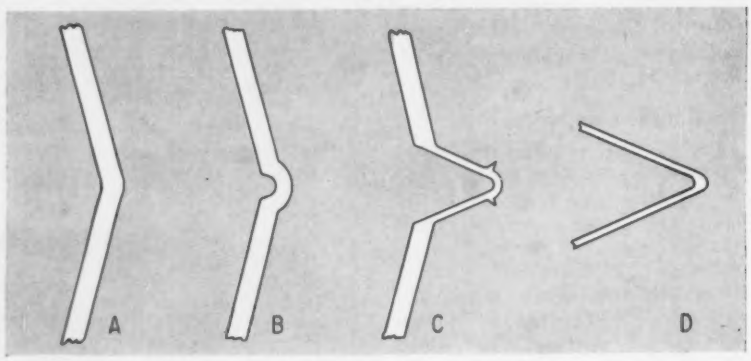
Hydraulic pressure applied to tailstock spindle forces cupped dimpling die and workpiece blank against nose of mandrel on Floturn shear-forming lathe. Dimple bore is thus shaped to fit mandrel nose

Shear-forming pointed nose cones

By John B Siegrist,
project engineer
New Brighton Plant, Ordnance Division
Minneapolis-Honeywell Regulator Co

Shear-forming of closed-end missile nose cones is a lot different—and a lot tougher — than shear-forming truncated cones.

The latter is a fairly easy operation if the truncated cone has a relatively broad face. Then, the blank is clamped securely to the end of the mandrel with a shaped tailstock adapter, and sufficient tailstock pressure is applied to keep the work from slipping on the rotating mandrel when it is contacted by the forming roller.



Cupped 0.345-in.-thick aluminum-alloy blank *A* is forced against nose of Floturn lathe mandrel with cupped die on tailstock spindle, forming ⅜-in. deep dimple *B* in center. Shear-forming *C* forces displaced stock into cup of small hardened-steel tailstock adapter (shaping the nose radius accurately), and up over nose of adapter

Shaping to a sharp point

But the job is much more complex when the closed-end nose cone for a missile must be shaped to a relatively sharp point (maximum tip radius for some cones is ¼ in.) Usually, one of two things happens—and either of them can result in a scrapped part:

- Contact pressure of the mandrel as it turns against the work is insufficient to keep the mandrel turning when the roller of the lathe contacts it. Result: The sharp nose of the mandrel bores a hole in the work.
- As more tailstock pressure is applied in an effort to keep the work turning with the mandrel when it is contacted by the roller, the small-diameter tailstock adapter penetrates and spoils the work.

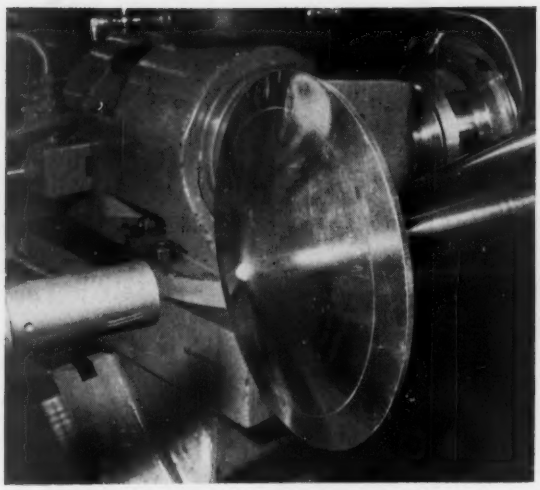
Faced with the job of shear-forming a number of such closed-end cones for an Army missile (from 0.345-in.-thick, 15-in.-OD, slightly dished blanks of 6061-C aluminum alloy), Minneapolis-Honeywell ran into considerable difficulty.

How it's done

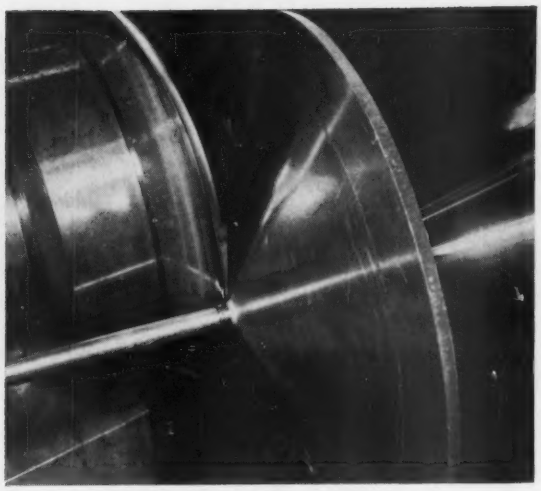
Then M-H Ordnance Division engineers came up with tooling that provided more contact area between the nose of the mandrel and the inner surface of the blank as the shear-forming began.

A ⅜-in.-deep dimple is formed in the center of the blank, using the nose of the mandrel as a punch and a cupped tailstock extension as the dimpling die. Not only does this increase the area of contact between the tip of the mandrel and the inner surface of the workpiece blank at the start of the operation—it also preforms the outer nose surface of the blank.

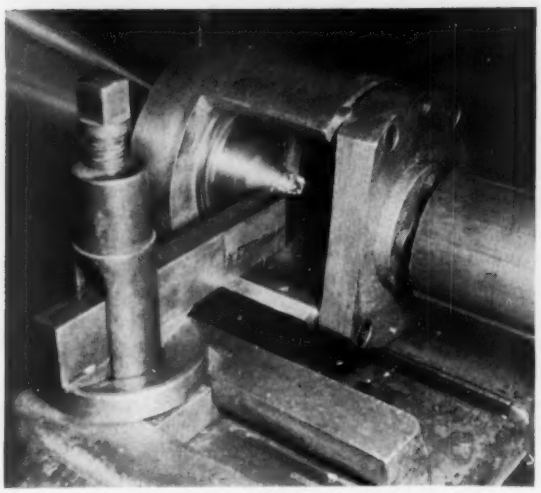
Then a small, separate, cup-shaped adapter is fitted to the outer end of a small-diameter tailstock extension so as to push the dimpled center of the blank flush against the nose of the mandrel.



Dimple formed in center of missile nose cone blank is approx ¾-in. OD on outer face of cupped blank. Small hardened-steel adapter (later mounted on small-diameter tailstock extension) fits over this dimple



Dimple formed in round aluminum-alloy blank is deep enough to permit contact of forming roller on its surface between small, cupped adapter and the cupped blank at the start of the shear-forming operation



Non-rotating tailstock extension on engine lathe has ball-bearing female center to support outer end of missile nose cone, and is slotted to permit entry of HSS formed tool with which excess stock is removed

Form tool for finishing closed end of missile nose cone is ground to provide a parting tool extension that trims mandrel-supported open end of cone to length. Normal speeds and feeds are used

The cup in this adapter is contoured the same as that of the nose of the finish-spun workpiece, and is highly polished. Periphery of the adapter is so shaped as to clear the forming roller, which is carried on the carriage of a Floturn lathe.

Shear-forming sequence

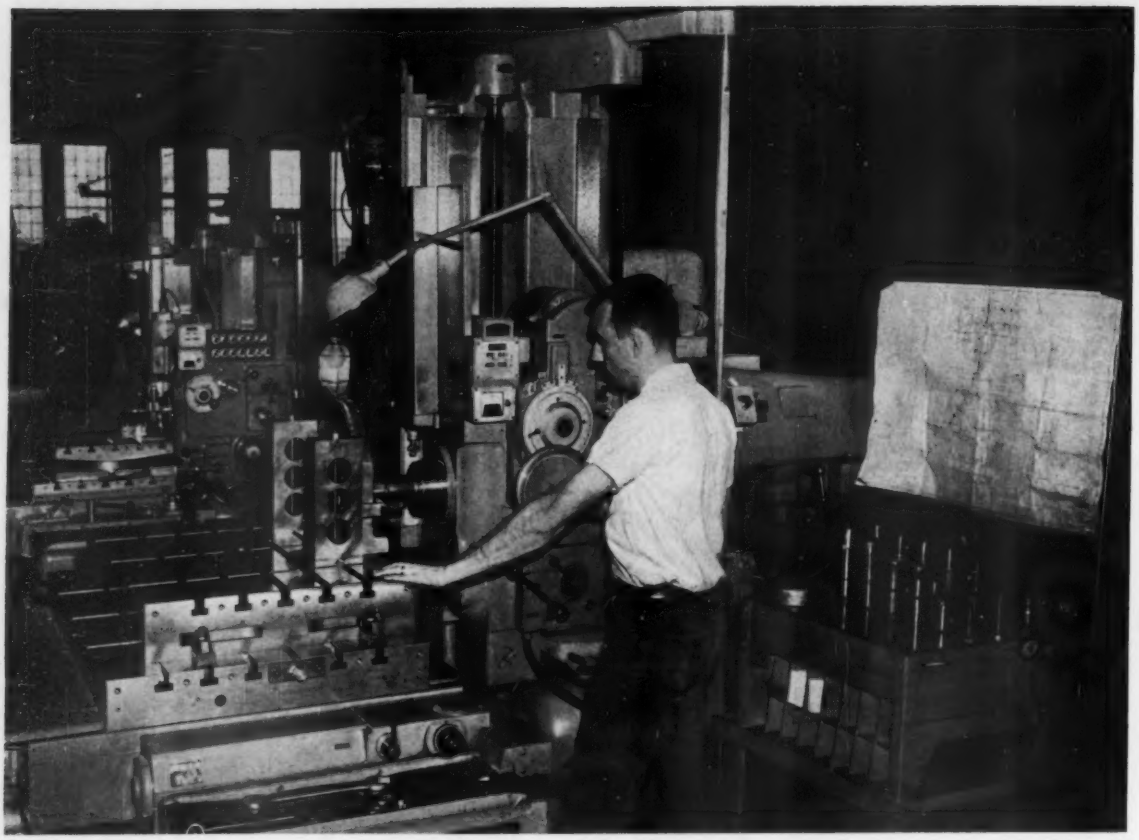
When shear-forming starts, first contact of the roller with the work occurs when the work is so far along the dimpled nose that the point of contact is backed up by the nose of the mandrel. And, because the adapter engages a larger portion of the work than was previously possible, adequate tailstock pressure can be applied to hold the work tightly against the end of the mandrel.

There is an added advantage to this arrangement. When forming starts, some of the work displaced by the roller flows back into the cupped adapter—filling the cup so as to shape the nose of the cone correctly. But some of this displaced material also flows up over the end of the adapter, and must be removed with a form tool in a subsequent lathe operation.

After heat treating, the nose cones are held on a shaped mandrel in an engine lathe—first for finish-forming the nose end, and then for trimming the outer end of the cone to the length called for in specifications.

Support the nose end

The lathe's tailstock spindle has an internal ball-bearing center which supports the nose end of the workpiece far enough back of the nose to allow a HSS form tool to be used on the nose. Support for the center bearing is cut away to clear the shank of the form tool, which is form-ground to serve as a nose end finishing tool and as a parting tool for trimming the other end of the part. •



Gear boxes and other parts for machine tools and fixtures are drilled and bored to tolerances as close as ± 0.0002 in. with digitally located Jigmils. Tools, preset to size, are delivered to machines along with the work

Four Jigmils do the work of six

Faster precision hole boring

Preset tools and direct dial positioning combine to speed up a time-consuming job. Efficiency has increased 40% and hole sizes and locations are now so accurate that inspection time has been cut in half

By Raymond Hoss, superintendent
Methods Department
Ingersoll Milling Machine Co
Rockford, Ill.

A bottleneck is no longer a bottleneck at Ingersoll's Rockford plant, where precision boring of accurately located holes has been speeded up with an increase, rather than a loss, in accuracy.

Now, with a combination of preset tooling and direct-dial numerical positioning, four DeVlieg Spiramatic Jigmils can do the work of six or even more machines of a similar type.

The holes are located and bored in small and medium-sized steel and cast iron housings and similar parts for machine tool assemblies and fixtures. With the new method, the job is being done about 40% faster, hole size and location accuracies have improved materially, scrap losses have been cut to a minimum, and the time required for inspecting finish-machined parts has been cut more than 50%.

Ingersoll has probably as wide a variety of work as any plant of comparable size in the United States, with the possible exception of a few large shops. Machining operations are largely non-repetitive (more than half the work is in lots of one, while less than 10% of the work consists of job lots of more than two workpieces).

Close tolerances

Not only that, the company's problem is further complicated by the need for machining tolerances closer than those in most shops. Most precision-bored holes must be

located within ± 0.001 in. or less, and many of them must be within 0.0005 of specified diameters.

All four of the Jigmils are equipped with Diatrol direct-dial positioning controls, and with spindles machined to take precision boring bars. The machines are capable of holding location tolerances of ± 0.0001 in. per foot, and are grouped closely in a straight line (see layout sketch). Roller conveyors simplify handling of tools and work to and from machine tables.

Tools go with drawings

All tools needed for a specified drilling or boring operation are delivered to the machines along with the work and work drawings.

Each work drawing shows (in decimal dimensions) the position coordinates for each hole to be machined, and the finished size for each hole. The operator is not required to convert, add or subtract drawing dimensions in order to determine hole locations with relation to reference surfaces.

With dial positioning, there is no need for a machine operator to secure, adjust, and use gage rods to locate the machine table and spindle precisely for each hole.

Because preselected and preset tools are delivered to the machine with the workpiece, there is no need for the machine operator to go to a crib for tools, or to sharpen and set them to size.

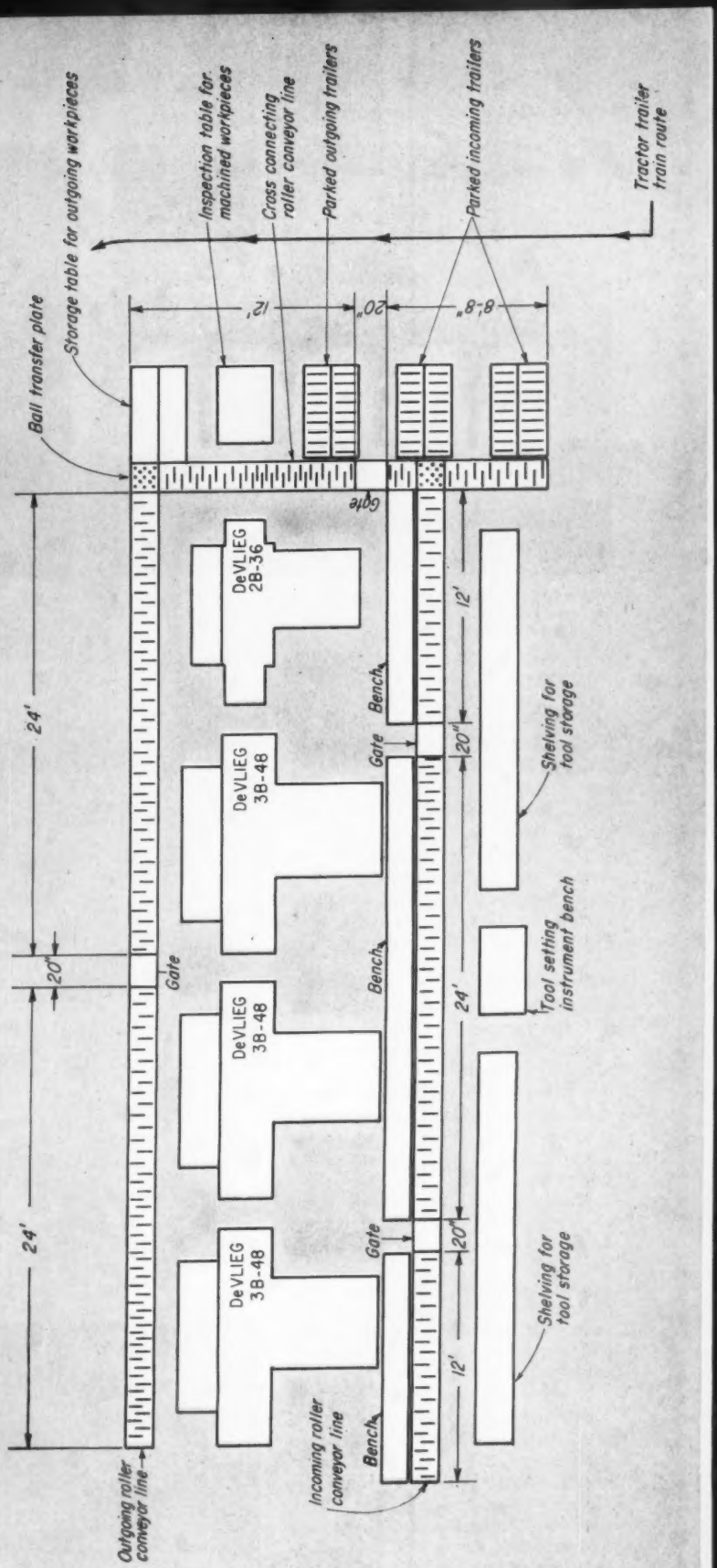
Also eliminated are trial cutting, checking and inspection of holes for size and location (except when tolerances under 0.0005 in. are specified).

Sequence of operations

The operator (1) sets up the workpiece—using a simple clamping fixture, (2) mounts preset tools in the spindle nose, (3) locates *X* and *Y* axis reference surfaces, (4) dials in the decimal dimensions for the first hole from the drawing, (5) positions his machine, and (6) drills and/or bores the specified hole. This is repeated until all holes called for on the drawing are rough and finish machined.

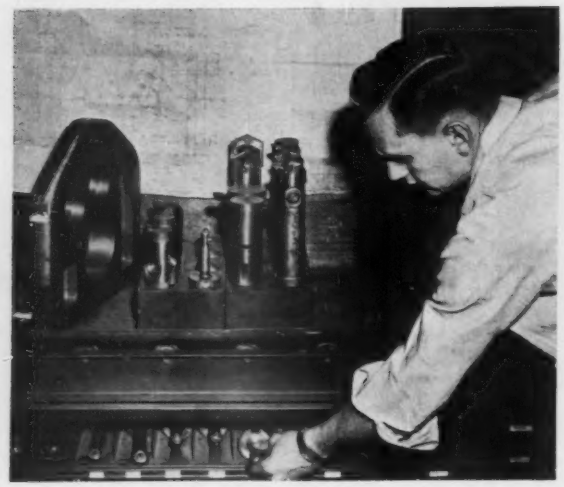
The machine operator is responsible for positioning the workpiece properly on the machine table, for dialing the hole location numbers correctly, and for using the right preset tools—but he is not usually responsible for the accuracy of hole locations and sizes.

The only time he checks for accuracy after starting a cut is when al-

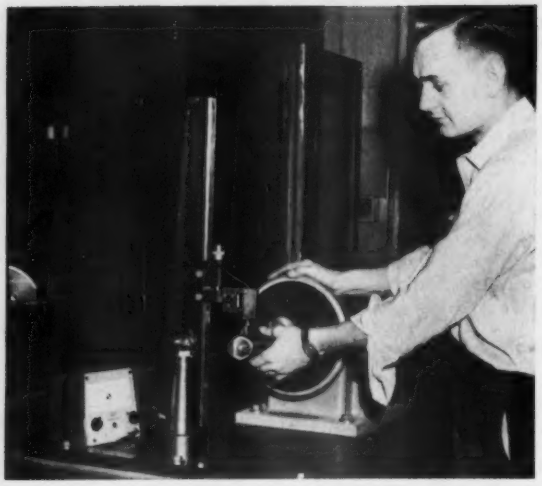


Roller conveyor lines cut down on cost of moving work and tools to and from the four Jigmils. Group leader in tool setting area selects tools for each job, sets them to size if necessary, and loads them vertically into racks on steel trays which carry the work to the machines

Faster precision hole boring . . .



Black and red china marking pencils are used to show sizes on tools placed in racks on workpiece trays by the group leader. Twist drills are used for opening small holes, but spade drills are preferred for roughing larger holes



Precision electronic comparator, used with a presetting spindle on a granite surface plate, accurately locates toolbits in precision boring bars. Both roughing and finishing bars are preset in this setup, and carbide bits are used in all bars

lowable tolerance is 0.0005 in. or less.

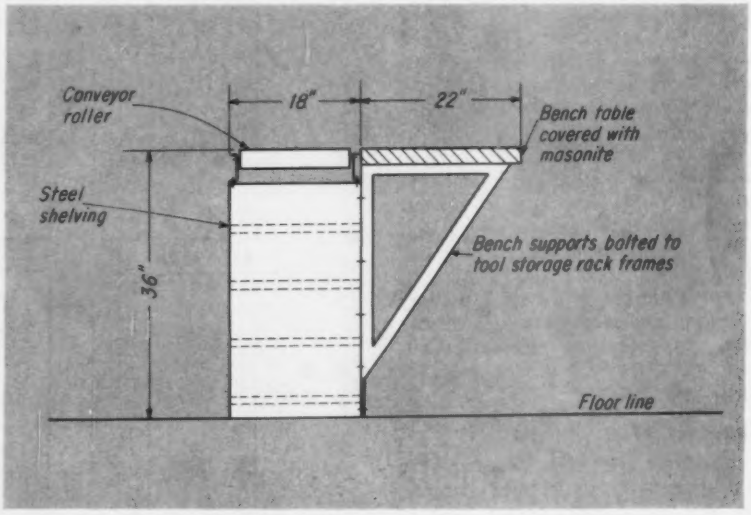
Key man in this precision boring group, the group leader, works in the tool setting area. He decides which tools will be needed for various operations, presets Microbore boring tools if necessary, and places the selected tools vertically in racks on the same trays that carry the work along the conveyor line.

Tool storage

Spade and twist drills, and standard and special DeVlieg Microbore holders and toolbit cartridges—all commonly used by this group of machines — are stored in compartment shelves installed below the incoming conveyor line, and under workbenches on each side of the tool presetting stand.

When one of the machine operators completes a job, he places the finished workpiece on a tray on the outgoing roller conveyor line for delivery to an inspection and truck pickup station. He then returns the used tools to his group leader in the tool presetting area, and gets his next job from the incoming conveyor.

Returned cutting tools are inspected by the group leader, and are either replaced in the storage shelves or, if dulled, routed to a nearby tool grinding group for resharpening. For Microbore tools, only the cutting bits are sent to the tool grinding group if resharpening is necessary. There they are routed to a Microbore grinder to insure development of the correct cutting edge geometry for fine finishing. •



Conveyor line for delivering work and tools to Jigmils is mounted on top of tool storage shelves. On machine side of line are bracket-supported benches where trays of pretooled jobs are stored

Standard and special cutting tools and bars and cartridges are stored in steel shelves under incoming conveyor line, and under workbenches in the tool setting area. Dulled tools are sent to tool grinding group before being returned to storage shelves. Only the cutting tips of Microbore tools need be sent to the regrinding group

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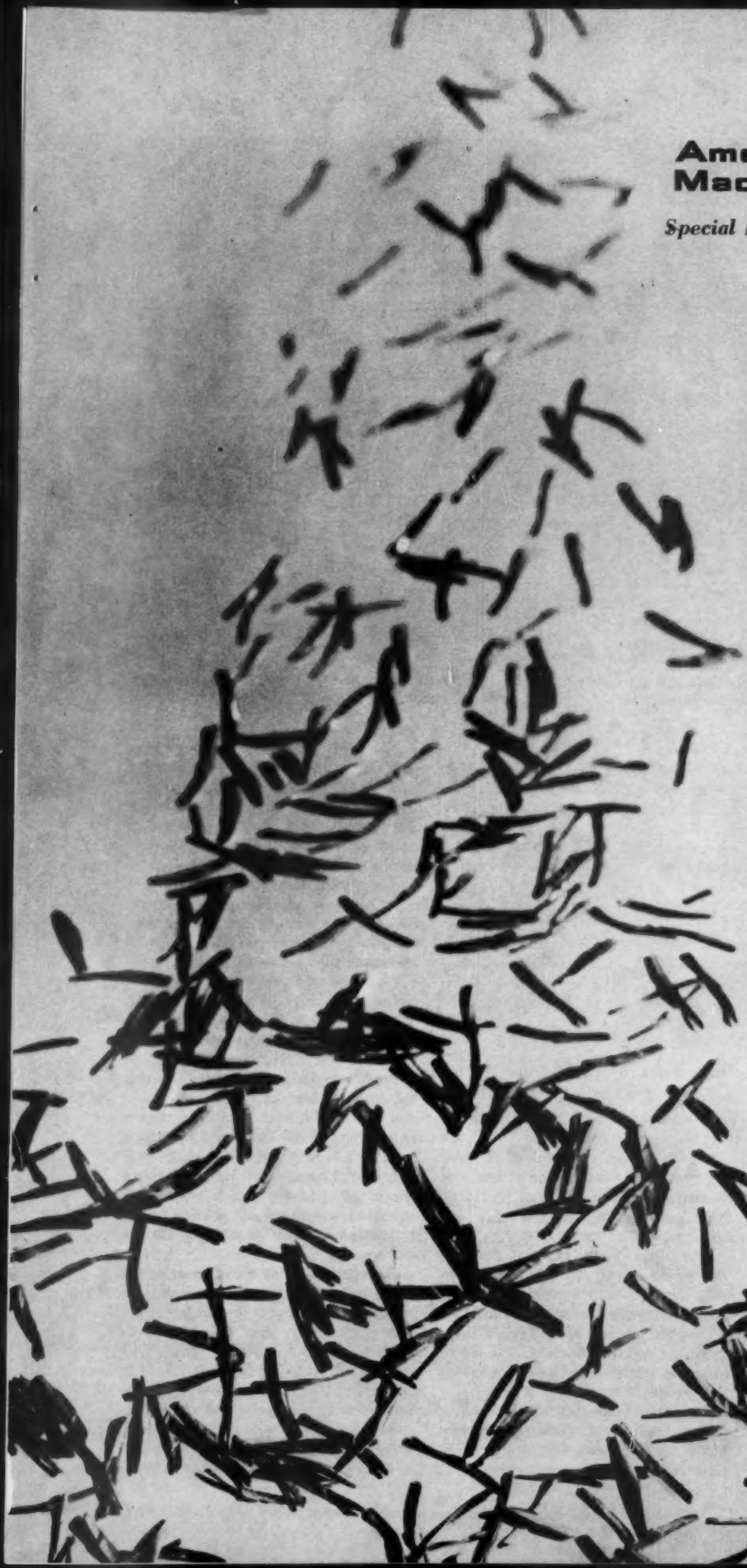
Special Report No. 509 July 24, 1961



PNEUMATIC CHIP REMOVAL

. . . a case study

By Alfred J Marchlewski,
design draftsman,
Anaconda American Brass Co,
Waterbury, Conn

Chips and shavings are always a nuisance and can be a real headache when generated in high volume. Here — step-by-step — is how one company solved the problem with air. These are copper chips produced by a milling machine, but the general principles are good for any situation

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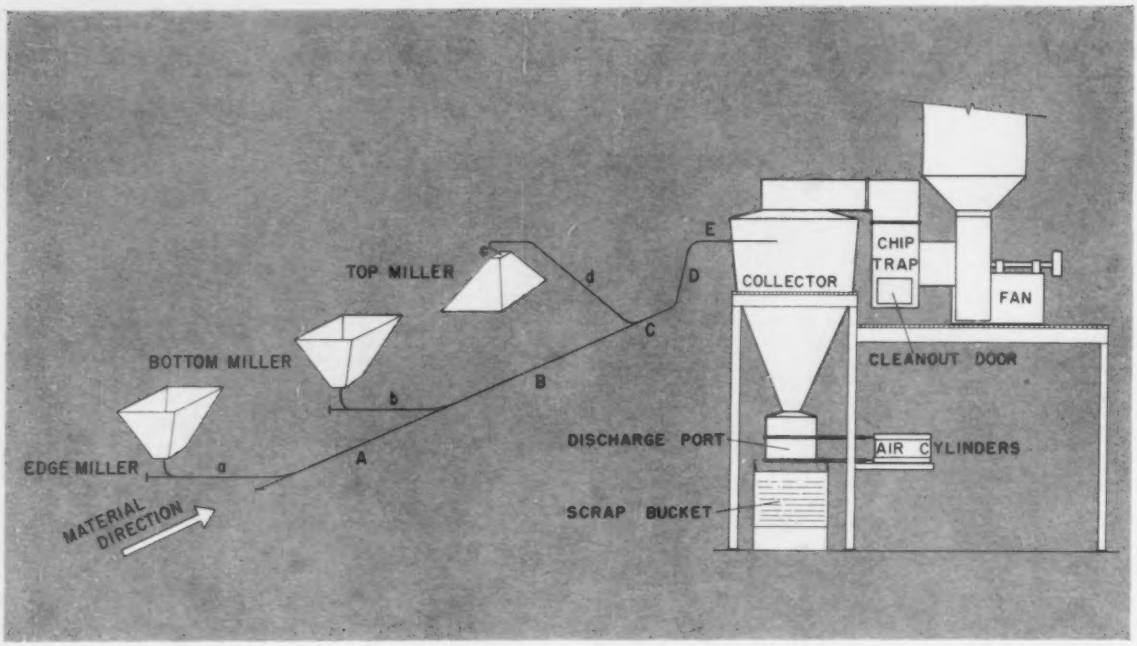
Pneumatic chip removal . . .



Pneumatic system collects chips from three locations and carries them through ducts to cyclone collector. At regular intervals, the discharge port goes through its cycle, dumping chips into scrap bucket, which goes to scrap dept when full

Manual chip handling is good enough up to a point, but when a cutting operation throws out more chips than you can handle manually, you have to graduate to a more sophisticated technique. This is especially true if the chips endanger the surface quality of work that has to be just about perfect, as they did in one of our operations.

There are many possible solutions to this problem, but after comparing them carefully, we decided that pneumatic conveying would work best in our particular situation.

In our Ansonia, Conn, plant, we mill copper strips all over to remove scale caused by annealing and hot rolling and to remove normal casting imperfections. These strips, up to 75 ft long, go through a milling setup that cuts all sides of the strip—edges, bottom, and top—in a single pass.

New, triple milling setup

This represents a departure from the conventional practice in the industry, which is to mill the top and bottom in separate passes, cutting both of them from the bottom. The combined operation is a recent innovation of ours aimed at improving quality and lowering manufacturing costs.

However, this improvement wouldn't be possible without an effective chip-removal system. The chips from the top miller, if not collected immediately, would be carried by the fast-moving strip into the machine feed rolls, which would press them into the milled strip and ruin the surface.

Therefore, we needed a system that would remove all chips and other foreign material from the strip, convey them away from the cutting area, and deposit them in a place where they could be conveniently removed from the system and processed as scrap.

Three ways to handle chips

The systems available for this purpose are distinguished primarily by the medium they employ to move the chips. The conveying medium may be air or water, or it may be mechanical. Each of them had both good points and bad ones for our application.

• A fluid flush system, for example, aims a stream of fluid (probably a water-soluble coolant) across the cutting area to sweep the chips off the strip to one side. Then it takes them out of the machine and down to a container or pipe, probably under the floor.

This is a very effective technique for removing chips from the strip, but it tends to make a sloppy operation. It's hard to control the spatter of coolant directed into the cutting area at high velocity.

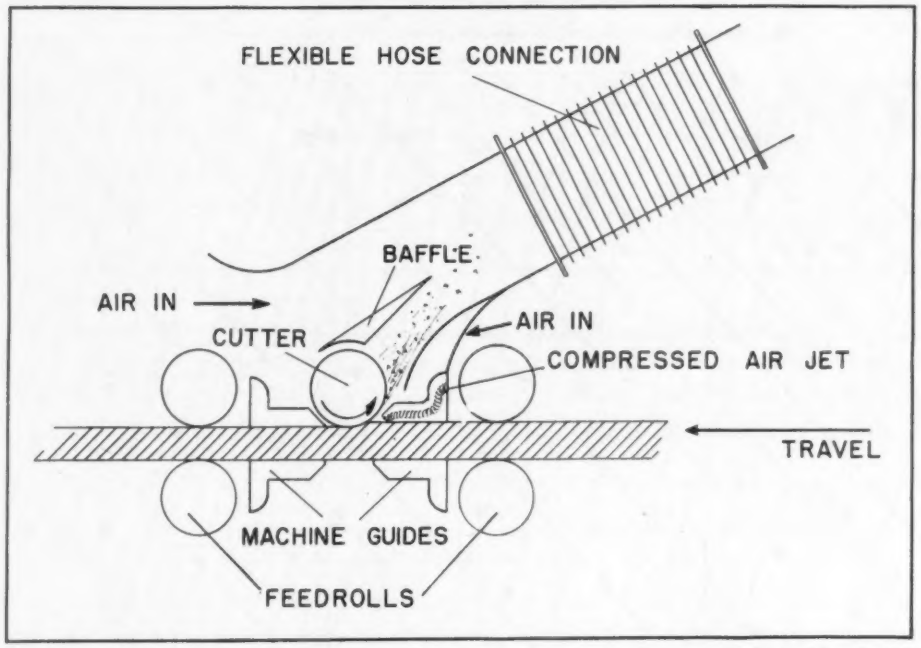
For our application, however, the real drawbacks of this technique would arise after the chips leave the machine. Before the coolant can be sent through the machine again, it must be pumped through an expensive filtering system that would take more space than we could give it in the machine area.

That would mean pumping the coolant and chips to another building to be separated. In a new plant, this kind of system would be much easier to work out, but we decided it involved too many problems in our existing layout.

• A mechanical system moves chips away from the machine simply and effectively with a conveyor belt or buckets, but it becomes more complex when we attack our major problem—cleaning all the chips off the strip before it passes between the rollers.

Revolving brushes, compressed-air jets, or a wiper arrangement might solve this problem in the average application, but ours involves a very limited working space. The cutting setup and feed rolls are only a couple of inches apart—not enough room for either the wiper or the revolving brushes to do their work effectively.

The compressed air jets could



Hood works in close quarters to collect chips from milling operation. Air enters at front of hood (left) and also through cutout at right to provide even flow that will carry the chips smoothly into the system

probably solve the problem by blowing the chips out of the cutting area to the side of the work. But that still would not deposit them on the conveyor, because our machine frame completely encloses the cutting area and the feed rolls.

Of course, ingenuity and large quantities of compressed air could take care of this, but then it would almost amount to a small pneumatic system, just to feed the chips to the mechanical system.

• A completely pneumatic system can be designed to capture the chips as they leave the cutter. In fact, the cutter itself is part of the chip-removal system, because it throws the chips into the entry hood; the air stream simply keeps them moving on through the system.

A few minor problems do arise in the cutting area because of dead corners on machine parts not swept clean by the flow of air. Small chips or scale dust could build up in these places, but with the help of a few compressed-air jets, they can be kept clear.

Air system takes least space

It also turned out that the pneumatic system would occupy a minimum of floor space, and that we would be able to mount the cyclone collector and fan on an overhead platform. With this arrangement, the collector could discharge into carts that could be wheeled directly into the scrap department in the adjacent area. Considering all these factors, the pneumatic system was clearly the best choice.

These chips are a typical sample of the ones produced by strip milling operation. Pneumatic chip system saves considerable time and effort in disposing of them

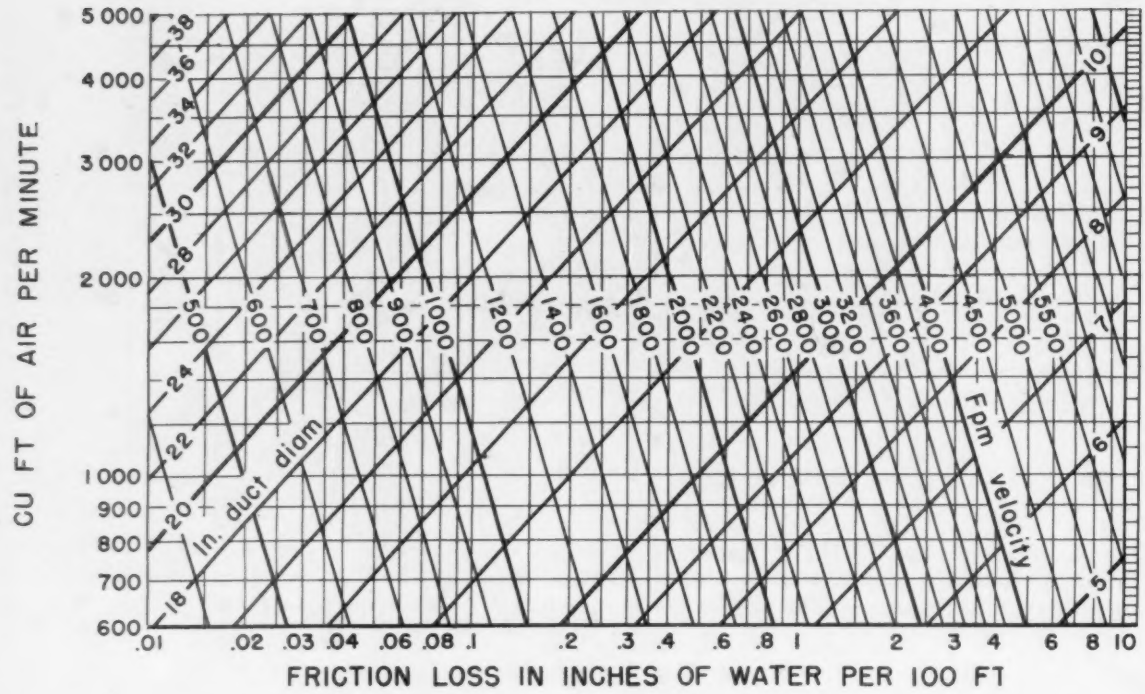
After we decided on pneumatic chip handling, we had to design the system, of course. And since air was to be the conveying medium, all the major problems were concerned with making it perform as we wanted it to.

Planning the system

First, we had to make a general layout, indicating what kinds of equipment we would need — entry hoods, cyclone collector, chip trap, and fan—and showing schematically how these pieces would be linked together by the ducts. Then we had

Friction of air in straight ducts

From Heating, Ventilating, Air Conditioning Guide 1960. Used by permission.



Based on standard air of 0.075 lb per cu ft density flowing through average, clean, round, galvanized metal ducts having 40 joints per 100 ft. *No safety factor included.* Caution: do not extrapolate below chart.

Friction chart shows relationships of velocity, volume rate of flow, and duct size, and also gives the friction loss per 100 ft of duct. To find volume rate of flow when duct is 7 inches in diameter and velocity is 5000 fpm, enter the chart on the diagonal line representing a 7-in. diameter and follow it up to the right to its intersection with the 5000-fpm velocity line (sloping *down* to the right). Then, read the cubic ft per min opposite this point, on the vertical scale at left. Estimated to the nearest 100, it is 1300 cfm. The friction loss in the 7-in. duct under those conditions can be read directly below this three-way intersection, on the bottom scale—5.5 in. of water per 100 ft of duct. Note: This chart is only a portion of full chart which has vertical scale from 10 to 100,000 cfm

When air stream carries chips, allowance is made for additional resistance by applying the formula:

$$F_m = F_a \left(\frac{R}{K} + 1\right),$$

where F_m = friction when handling material, F_a = friction of air alone, R = ratio of chips to air (weight), and K = a constant that depends on velocity, thus:

Velocity (fpm) =	2000	3000	4000	5000	6000
K =	1.15	2.14	3.11	3.50	3.50

In the accompanying chip-removal problem, R is 0.25, and velocities are 5000 and 6000, so the formula yields a correction factor of 1.07. Therefore, friction losses found on the chart must be multiplied by 1.07, if duct is carrying chips

to calculate the system so we could specify the correct sizes for all this equipment.

The first pieces of equipment in the system, the entry hoods, are also the most critical. They must accept the chips thrown into them by the cutters, and they must create the proper air pattern in the cutting areas, especially in the top-cutting operation—or the system will start off on the wrong foot.

Chips leaving the cutter have a good deal of momentum, and there should be no obstruction in their path. The shape of the hood and its position should let this momentum carry them far into the supporting air stream.

Any straightening vanes or baffles within the hood should contribute to smooth flow. However, unless care is exercised, baffles close to the rotating cutter can form a scroll effect, turning the cutter into an air compressor, and in turn, reducing the air flow through the entry.

Hoods must allow access

In our application, the hoods also had to allow access to the cutting area so the operator could change or adjust the cutter and adjust the workpiece guides for different thicknesses of strip. After testing several hood shapes, we selected one that satisfied all these requirements.

At the top miller a flexible metal hose connection between the hood and the ductwork lets the cutting adjustments be made without affecting the system vacuum. The other two hoods do not need this arrangement because they work from below the cutters.

Next, we had to decide whether to plan on a direct system or a draw-through system. In the direct system, the air and chips pass through the fan and then into the cyclone collector. In the draw-through system it's the other way around—the air drops its load in the cyclone collector before passing through the fan.

Either system will do a satisfactory job, but the direct system is much noisier. For this reason, we decided on the draw-through system.

That meant, of course, that our

cyclone collector would be placed in front of the fan. Instead of a cyclone collector, we might have used a gravity settling chamber, which simply reduces the air velocity so that the air stream can no longer support the chips and they drop into a hopper. However, this device needs more space than we could give it.

An important consideration in the draw-through system is the method of discharging the chips from the collector. We can't just open the bottom of the hopper to dump them, because the collector is part of the suction end of the system. Air coming in through the hopper would then short-circuit the air stream from the entry hoods, and the chips en route would fall and clog the ducts.

Discharge port holds vacuum

Our solution to this problem is the double-slide discharge port shown on page 96. When the bottom slide is opened to dump chips, the upper slide keeps air from entering the opening. Then, when the bottom slide closes, the top one opens and lets more chips fall into the discharge section.

This device operates automatically, with pneumatic cylinders driving the slides through a complete open-and-close cycle every 3 min, 20 sec. Operating at this frequency, the discharge port doesn't need a large storage capacity, so we saved on headroom.

The chip trap is an optional piece of equipment in a system of this sort, but for us it solves a longtime problem by making certain that no chips travel through the collector and fan and on up the discharge stack to be deposited on the roof and the adjacent yard.

It also acts as a safety device. In case the system malfunctions, the chips are caught here and can be removed through a cleanout door.

Calculating the system

Once we had decided on the major components and drawn the schematic layout on page 96, the next job was to work through the system calculation so we could specify the exact duct sizes and the capacity of the other elements of the system. Any system calculation involves a lot of detail, but here is a step-by-step account of how this one was worked out.

Let's start from scratch. There are two basic factors needed to make the system operate: (1) enough air (cfm) entering each of the three hoods to carry the chips being thrown into the system by the cutters, and (2) enough velocity to hold the chips in suspension and carry them through the ducts to the cyclone collector.

Of course the fan, ductwork, and other components all must do their share toward achieving the two major goals, and the object of the calculations is to make sure they will.

Calculation procedure

First, we determined how *much* air was needed (1 above) by relating it to the rate of chip production. Next, we calculated what diameter each section of duct should be to make the air move at a given velocity (2 above).

Then we worked out the figures needed to specify the fan for the system—its capacity (in cfm) and the pressure at which it has to operate. The capacity is simply the total amount of air entering the three hoods, but the pressure is a little more difficult to calculate.

This pressure is the measure of how much energy the fan must develop to overcome the total resistance of the system. Resistances are caused by friction, by turbulence, and by the fact that air must be accelerated from a state of rest to a state of motion.

One of the most valuable aids in these calculations is *Industrial Ventilation*, published 1960 by the Committee on Industrial Ventilation, P O Box 453, Lansing, Mich. This contains many of the factors needed for calculating a pneumatic chip-removal system.

The same organization publishes standard calculation tables, which are a great help because there are a number of details to keep track of. Page 101 shows the calculation of our chip-removal system worked out on one of these tables, except that we have made a few minor changes in column headings to suit our own problem.

Rate of chip output

But before starting to work with the table, we had to know what capacity we needed. What weight of chips per minute would the system have to handle at peak load (when the milling cutters are making the deepest cuts) and how much of this would come from each of the three milling machines?

The strips that we process range from 1 to 6 inches wide and from 0.375 to 1.000 inch thick. In order to obtain a clean, flaw-free surface on these strips, we remove an average of 0.018 to 0.022 in. of metal from each surface.

Therefore, our maximum chip generation occurs when all these figures are on the high side of the range and when we are cutting at maximum speed—45 fpm. In the first machine, which mills both edges at the same time, we remove about 24 cu in. of metal per min.

The second machine mills the bottom and, under these conditions, removes about 71.5 cu in. per min. The output of the third machine, the top miller, is the same as the second, so the total for all three machines is 167 cu in. per min.

With copper weighing 0.317 lb per cu in., the edge mill is throwing out about 7.6 lb of copper per min. and each of the others, about 23 lb per min.

The total comes to 53.6 lb per min. and our chip-removal system has to handle all of this, conveying the appropriate amount through each branch line and the main line to the collector.

Air-to-chip ratio

What does it take to move all these chips? On the basis of our own experience and other studies on the flow of non-homogeneous fluids, we decided we would need 50 cu ft of air for each pound of chips. This ratio has given us our best results on similar problems.

At this point it's worth noting that these chips have rather good characteristics for pneumatic conveying. Most of them come from the cutter as a thin helix about 3/16 in. wide and 1 in. long. This type offers a curled surface to the conveying medium, and the moving air picks it up easily.

Too, a certain amount of small particles comes from scale on the surface of the strips being milled, but these pose no great problem and are easily moved with the chips.

The next important factor is how *fast* the air must move to hold the chips in suspension and take them to the collector. The 50 cu ft mentioned above will carry a pound of chips, but only if it is moving fast enough.

Here again, published recommendations and our own experience were our guides. We decided to aim for 5000 fpm in the horizontal lines and 6000 fpm in the vertical risers.

"Aim for" is the correct way to state it, because you can't calculate

a duct size to the thousandth of an inch and expect a tinsmith to make it that way. They work only in inches and rough fractions, but if the actual velocity is within 5% of the desired velocity in each duct, the system should work satisfactorily.

Set up the table

Once we had established the figures for quantity of air and velocity, we began working with the calculation table. Let's take this as a typical problem to be worked out. First, allow a line for each section of duct and each piece of equipment (as show in the example).

The above ratio of 50 cu ft of air per pound of chips indicates that we should figure on a total of 53.6 x 50 or 2680 cu ft of air per minute to operate the system. That would be 380 cfm for branch "a" and 1150 cfm for each of the other two branches.

Normally, we would enter these figures on the appropriate lines in column 4, but you can see that the figures in the example are much higher. That's because practical experience has led us to use no piping smaller than 7 in. diameter for our particular kind of chips. Otherwise the chips might become blocked up in the ductwork.

Therefore, with a diameter of 7 in. and a velocity of 5000 fpm, we have about 1300 cfm flowing through each branch. This is more than actually needed for any of them, but the pipe diameter is the controlling factor here.

Column 5 shows the cumulative volume of air flow through the mains. Here the duct diameters are greater than 7 in. so they are governed by the velocity and volume of air flow.

Friction chart saves work

We could calculate these diameters with a slide rule, but the ASHRAE Friction Chart (p 98) saves us the trouble. Along with the chart is an explanation of how to determine duct diameters and friction losses and how to allow for the additional friction loss caused by chips in the air stream.

Following these procedures, we can fill in columns 2 and 11 for all branches and mains up to the collector. Column 3 is blank, because the friction chart eliminates working with cross-sectional areas.

The column-11 entry for section "c" is high because the section is made of flexible tubing. The friction loss in flexible tubing is 1.5 times the loss in sheet-metal duct, so we adjust the value accordingly.

Now we are ready to find the total *effective* length of each duct. The layout length goes in column 7, and the number of elbows and entries in column 8.

The elbows and entries cause a good deal more resistance than straight ducts do, so we must allow for the difference. In a 7-in. pipe, for example, a 90° elbow with a radius of 14 in. will cause as much resistance as 9 ft of straight pipe.

The manual, *Industrial Ventilation*, gives this information in tables that show equivalent lengths for a whole range of pipe sizes and elbows. From this we can fill in column 9 and then add it to column 7 to arrive at the total length in column 10. Note that there's no entry counted for branch "a" because it is entering the end of the main. You might consider it an extension of the main.

After this it's a simple matter to multiply column 10 by column 11 and divide by 100 to fill in the frictional resistance of each run in column 12. This is the pressure that the fan must exert in each section of duct to keep the specified volume of air moving at the specified speed.

Must accelerate the air

But we also have to accelerate the air from rest—and bring it into the system through the three hoods. In column 13 through 16 we will calculate the combined pressures required to do these two jobs.

Then, by adding these pressures to the pressure just calculated for overcoming friction, we will arrive at the total pressure required to operate each section of duct and can find the *run* with the highest total pressure. This pressure will become the *governing pressure* in the collection end of the system. When the fan operates at a high enough pressure to take care of this run, it can also take care of the others.

And now back to column 13. The velocity pressure (VP) is the pressure, in inches of water, gage, required to accelerate air from rest to the velocity in the duct being considered. From the formula:

$$VP = \left(\frac{fpm}{4005}\right)^2$$

we can fill in this column for the branch lines. We do not make this calculation for the mains, because the air is already moving when it enters the mains, i.e., it already has its velocity pressure.

In a theoretically perfect entry hood there would be no loss, of course, and the velocity pressure alone would be able both to accelerate the air and to bring it into the system. Unfortunately, there's no such thing as a perfect entry hood; we always have to compensate for the entry loss caused by turbulence.

The manual can help here, because it contains diagrams and data for certain standard types of hoods, along with their entry-loss factors. By comparing our entry hoods with these, we can find the figures to enter in column 14. For the first two hoods, it is 1.0VP.

The hood for the top-milling operation, however, is a special case. The shape of the machine placed additional obstructions in the path of the incoming air, so we checked the hood by making actual field tests. The tests showed that we would have to allow for an entry-loss factor of 1.47VP.

The effect of entry loss is to interfere with the work that velocity pressure is trying to do—accelerate the air from rest. Therefore, the entry-loss factor is a multiplier, stating the amount of additional velocity pressure needed to overcome this loss of efficiency.

Column 15 is the easiest one in the whole calculation. Simply add 1.00 to every figure in column 14. Then, multiplying column 13 by column 15 will automatically add together the velocity pressure and the correction.

Thus, column 16 gives the combined pressure required to accelerate the air and to bring it into the system through each hood. In column 17, this pressure is added to the pressure needed for overcoming friction in each duct (column 12) to arrive at the total pressure required to operate each section of duct.

Find governing resistance

Now we can find out which *run* will have the greatest resistance. Actually, there are three parallel runs that start at the entry hoods and go clear through the system. However, they follow different paths only in the collection end of the system, so by adding up the resistance for each one up to the collector, we can see which is the highest.

One of the runs is: a—A—B—C—D—E. The second is: b—B—C—D—E. And the third is: c—d—C—D—E. The total resistance of each of these runs is: 7.06 for the first, 7.14 for the second, and 8.72 for the third.

Obviously, the third is the highest. This figure now becomes the governing resistance for the collection end of the system, so we move it

Calculation table for pneumatic system

1	2	3	4	5	6	7	8		9	10	11	12	13	14	15	16	17	18
Section of branch or main	Dia of duct (in.)	Area of duct (sqft)	Air volume (cfm)		Vel (fpm)	Length of duct (ft)					Resistance (in. of water, gage)				100 plus col 14	Col 13 times col 15	Col 12 plus col 16	
			In branch	In main		Straight runs	Number of Elbows	Entries	Equiv Length	Total Length	Per 100 ft	Of duct section	VP	Entry loss factor	Hood suction factor	Hood suction	Total resist of section	Gov pressure
a	7		1300		5000	3.5	1-90 1-45		13.5	17	5.9	1.0	1.56	1.0	2.0	3.12	4.12	
A	7			1300	5000	3				3	5.9	0.18					0.18	
b	7		1300		5000	3.5	1-90	1-45	18	21.5	5.9	1.26	1.56	1.0	2.0	3.12	4.38	
B	10			2600	5000	7				7	3.5	0.25					0.25	
c	7		1300		5000	2	flex tubing			2	8.9	0.18	1.56	1.47	2.47	3.85	4.03	
d	7		1300		5000	10	2-90	1-45	27	37	5.9	2.18					2.18	
C	12			3900	5000	5	2-90		34	39	2.8	1.09					1.09	
D	11			3900	6000	10				10	4.4	0.44					0.44	
E	12			3900	5000	35				35	2.8	0.98					0.98	8.72
Collector					1800								0.20	1.5			0.30	9.02
Chip	Trap				1800								0.20	0.75			0.15	9.17
Stack	22			3900	1500	20	1-90		50	70	0.13	0.09					0.09	9.26
Weather Cap				3900	1500								0.14	0.10			0.02	9.28

over into column 18. Later, when the system is installed, resistance will have to be *added* to the other two runs—enough so they will equal the governing resistance. Otherwise, the high - resistance duct would be "starved" and could not handle the expected volume of chips.

At present, however, we will continue calculating the resistance of the system to determine what fan to order. In addition to overcoming the governing resistance of the collection end of the system, the fan will have to deal with the dynamic resistance (mostly turbulence) in the cyclone collector, the chip trap, and the weather cap, as well as the friction resistance in the stack.

Losses in the collector

When the mixture of air and chips enters the cyclone collector, the chips drop out of the air stream because of the combined effect of the cyclonic flow and the loss of flotation velocity caused by the larger cross-sectional area.

The various collector sizes to choose from are numbered by the manufacturer in accordance with the diameter of the pipe leading to them. Thus, the 12-in.-dia. line calculated here would mean a No. 12 collector. However, space permitting, it is best to allow a safety factor by selecting one size larger—a No. 14 in this application.

The manufacturer also specifies what factor to employ in calculating the resistance of the collector. This is stated as an entry-loss factor, because the largest part of the resistance here is caused by turbulence. However, as the air is already in motion when it enters the collector, there is no entry for column 15.

The No. 14 collector has an entry-loss factor of 1.5VP. The normal outlet for this collector is 28 in. in dia, but because of space restrictions in the layout, this is reduced to the rectangular equivalent of a 20-in.-dia duct. Thus, the effective velocity through the collector is 1800 fpm. This in turn, gives a velocity pressure of 0.20, with the help of the formula for VP. The entry for column 17, then, is 0.20 x 1.5 or 0.30.

Next, the air enters directly into the chip trap where a baffle effect helps remove any chips that might remain in the air stream. Here, too, turbulence is the problem; and once again, it is turbulence without acceleration.

The manual shows that the pressure loss for a simple trap is between 0.5 and 1.0VP, so we select the midpoint, 0.75VP. As the air is still moving at 1800 fpm, the entry for column 17 is 0.20 x 0.75 or 0.15.

Lower velocity in stack

After leaving the chip trap, the air passes through the fan and up the stack to the roof. It would be reasonable to hold the velocity at 1800 fpm, but the lower velocity of 1500 fpm helps make sure that no chips will be blown out on the roof.

In order to move 3900 cfm at a velocity of 1500 fpm, it takes a 22-in.-dia duct, according to the friction chart. Under these conditions, the resistance per 100 ft of duct will be 0.13 in. of water, gage. This figure comes straight from the chart, without the 1.07 factor, because the air stream is no longer carrying material.

With a length of 20 ft plus a 90° elbow (equivalent to 50 ft of duct), total length is 70 ft. Multiplying this by the friction factor gives a friction resistance of 0.09 in. for the duct. As there is no entry loss, and as the air is not being acclerated, this quantity goes directly into column 17 as total resistance.

The last item that causes resistance is the weather cap. Figures in the manual show that when a weather cap is twice the diameter of the duct and is located one duct-diameter above the end of the duct, its loss is 0.10VP. This figure is shown as an entry-loss factor (column 14), even though the air is leaving, not entering. Multiplying it by the velocity pressure (0.14) gives 0.02 for column 17.

The cumulative addition in column 18 now indicates that the fan must operate at a pressure of 9.28 in. of water, gage. We also know that it has to move 3900 cu ft of air per min, so we can select a suitable product from the manufacturers' catalogs.

This completed the calculations and provided all the information needed for ordering equipment and install-

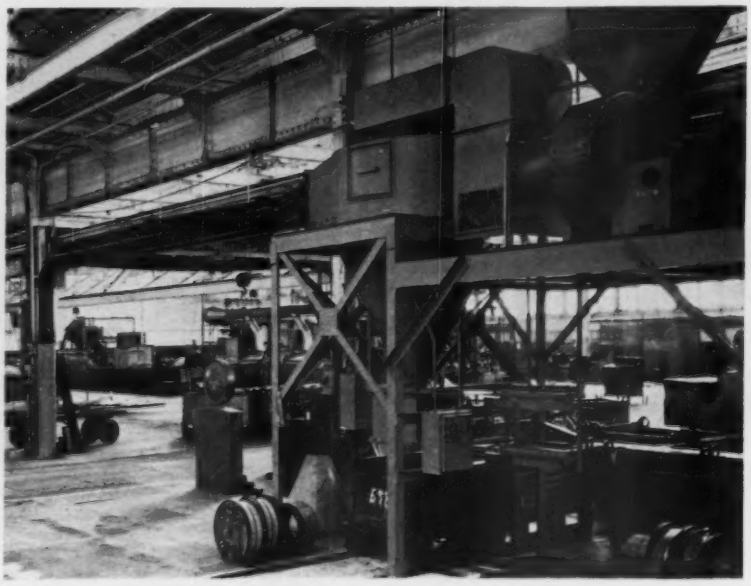
Pneumatic chip removal . . .

Triple milling operation produces large volume of chips that travel through three branch lines (two are under floor) and up through main duct (at right) to cyclone collector in picture below. Collector discharges into boxes on roller tracks

ing our system. Once it was set up, however, we still had to balance the resistance in the three branch lines to make sure none of them would be "starved."

That meant we had to add resistance to two of them to bring them up to the governing resistance. The conventional method is to install dampers or adjustable gates in the lines, but in a system such as ours, the chips would probably accumulate against any such obstructions.

Therefore, our solution was to add slide-type dampers at the hood entrances. Then we adjusted the slide positions until all three hoods were drawing the same amount of air. After each adjustment, we checked the velocity pressure at each hood with a pitot tube. When we reached the point where all three had the same pressure, the system was in balance and ready to go to work. •



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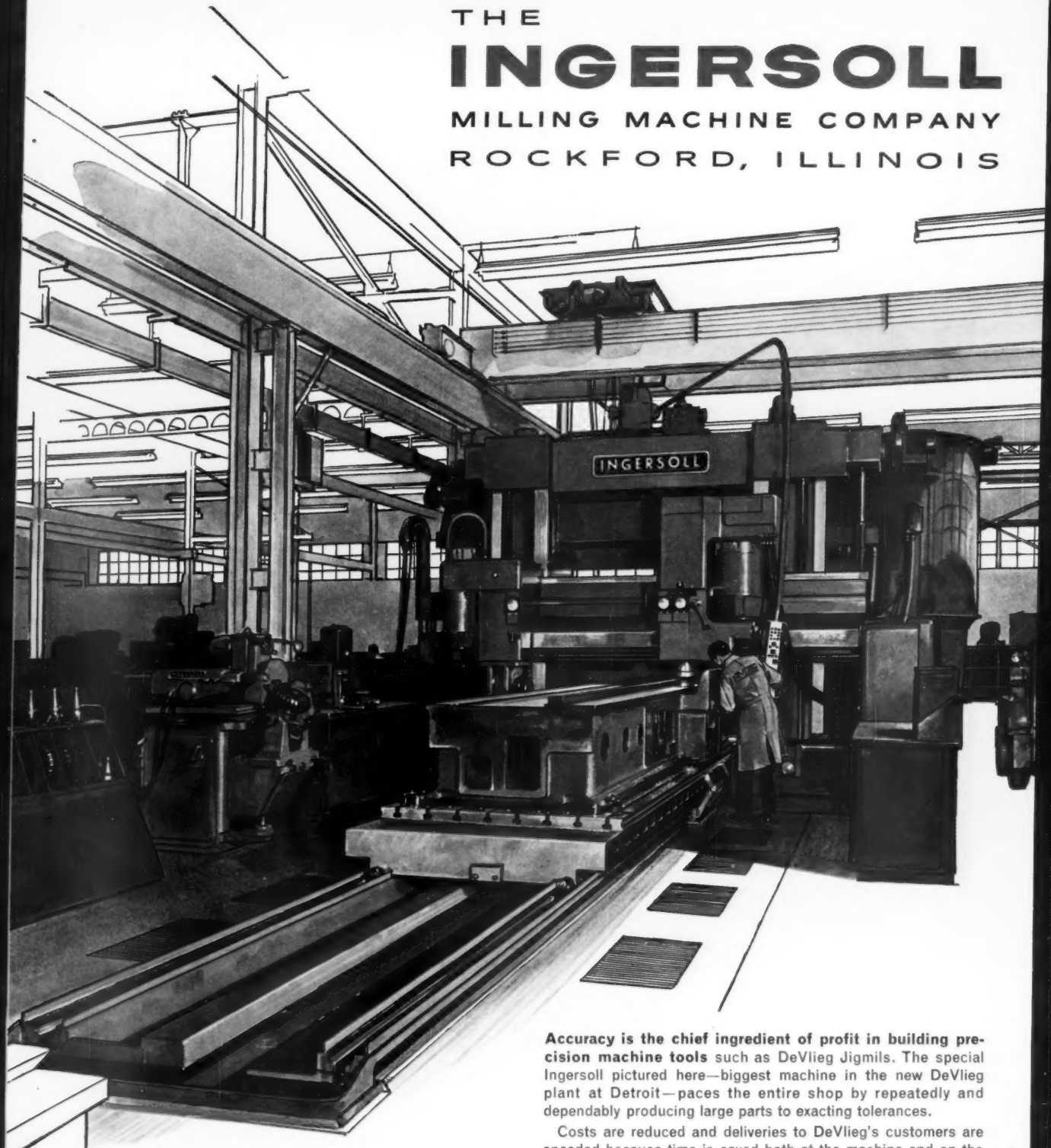
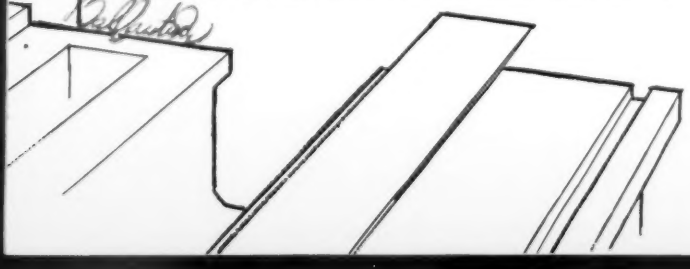
CIRCLE 317 READER SERVICE CARD ►

THE INGERSOLL MILLING MACHINE COMPANY ROCKFORD, ILLINOIS



IN MANY WAYS, *IN MANY PLACES . . .*

special Ingersolls help to reduce costs, increase profits.

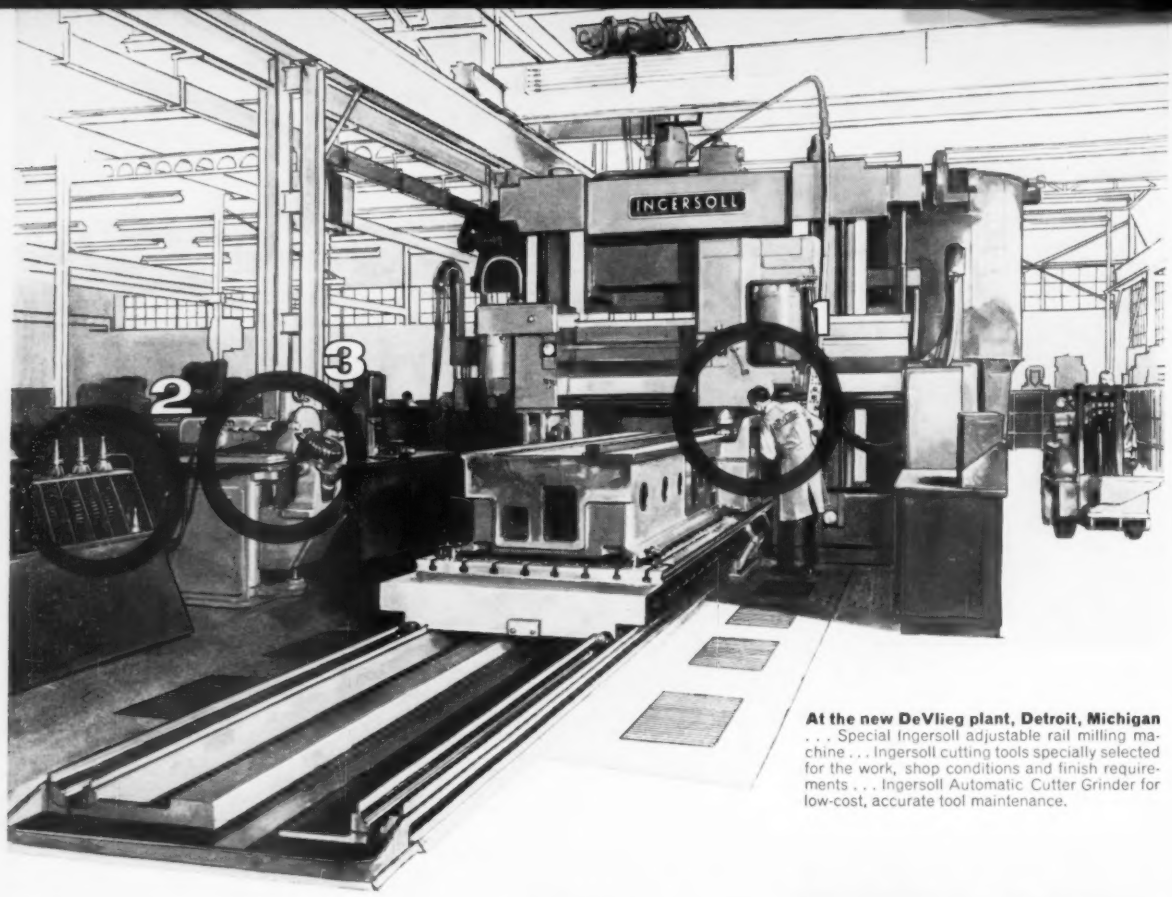


Accuracy is the chief ingredient of profit in building precision machine tools such as DeVlieg Jigmils. The special Ingersoll pictured here—biggest machine in the new DeVlieg plant at Detroit—paces the entire shop by repeatedly and dependably producing large parts to exacting tolerances.

Costs are reduced and deliveries to DeVlieg's customers are speeded because time is saved both at the machine and on the assembly floor. The machine's cutting capacity, coupled with good work methods, precision Ingersoll tools and tool grinding equipment, has eliminated many machine hours. Its accuracy has eliminated many hours of hand finishing.

There are other gains—highly significant though less readily evaluated: Reduced setups and handling time . . . reduced indirect labor hours . . . reduced crane demands . . . reduced inventories of work-in-process.

The machine's true profit making ability is the sum of all these savings.



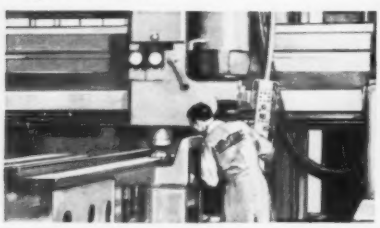
At the new DeVlieg plant, Detroit, Michigan . . . Special Ingersoll adjustable rail milling machine . . . Ingersoll cutting tools specially selected for the work, shop conditions and finish requirements . . . Ingersoll Automatic Cutter Grinder for low-cost, accurate tool maintenance.

HOW INGERSOLL CUTTER SERVICE ASSURES PROFITABLE MACHINE PERFORMANCE

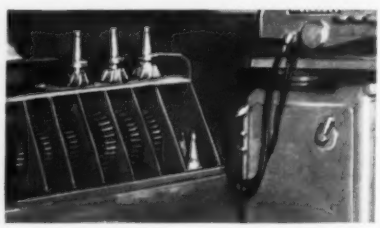
■ If you are responsible for the performance and/or the profitability of milling or boring machines, you may be able to save time and money as well as avoid serious trouble by getting the facts about the exclusive Ingersoll Cutter Service.

Ingersoll's Cutting Tool designing and manufacturing facilities are unsurpassed. In addition Ingersoll has one of the best cutting tool testing laboratories in the world . . . the shop where Ingersoll builds, erects and tests special machines. Here cutting tools of virtually every type and kind are continually being evaluated. Cost reducing tool maintenance procedures are also under constant development.

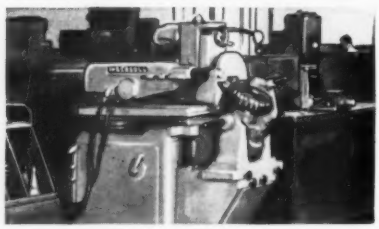
You can be sure of metal removal performance that more than justifies the machine investment when cutting tools are:



1 DESIGNED to fit the individual machine, the shop conditions and the material. An important part of Ingersoll's Cutter Service is close cooperation with customers' engineering, operating and purchasing personnel in analyzing individual requirements. Such an analysis results in recommendations for the most effective and economical cutting tools.



2 SUPPLIED in the right quantity, at the right place, at the right time. The Ingersoll Cutter Service often enables users to reduce inventories yet be sure of having (either in their stockrooms or ours) an adequate supply of standard or special Ingersoll cutting tools and blades. In addition Ingersoll is now equipped to give fast emergency service to meet customers' emergency needs.



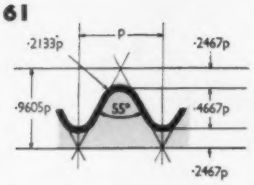
3 MAINTAINED to provide their original design geometry consistently and to assure maximum metal removal and minimum cost. Big savings in dollars and time, as well as improved performance, are often made possible by analysis of tool maintenance equipment and procedures. The Ingersoll Cutter Service includes this important area in working with many customers. Ingersoll sales engineers are well qualified to assist in establishing cost reducing maintenance procedures. They have the experience and knowledge to recommend the most effective equipment and methods, depending on the conditions in each shop . . . whether or not Ingersoll manual, semi-automatic, or automatic Cutter Grinders are indicated.

The Ingersoll Cutter Service may be able to help you cut costs or improve machine performance. Ask to have an Ingersoll sales engineer tell you how. Write:

THE
INGERSOLL
MILLING MACHINE COMPANY
CUTTER DIVISION
505 FULTON • ROCKFORD, ILLINOIS

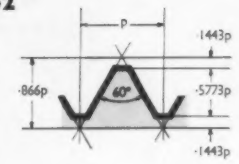
World Screw-Thread Forms—V

61



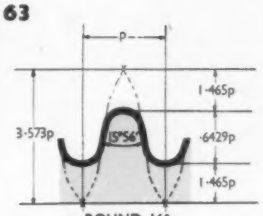
SPECIAL WHITWORTH
Germany DIN 30293

62



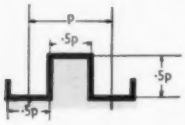
SEWING MACHINE 100
Germany DIN 5308

63



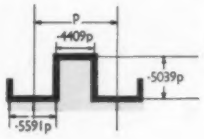
ROUND 16°
Germany DIN-262

64



SQUARE
Rumania STAS 3125
Hungary MNOSZ 206

65



SPECIAL SQUARE
Rumania STAS 4814

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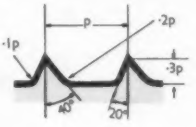
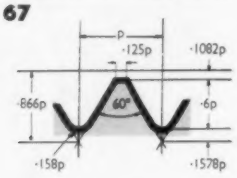


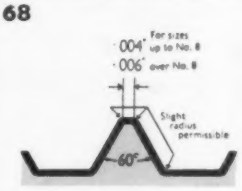
SLEEPER SCREW
Germany DIN 5913

67



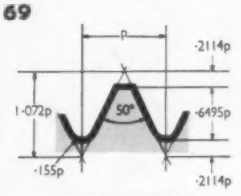
American NATIONAL MINIATURE

68



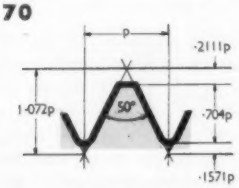
SELF TAPPING SCREWS
(Spaced Thread) Types A & B

69



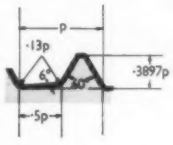
METRIC FINE 50°
Japan JIS. M.BO.0201

70



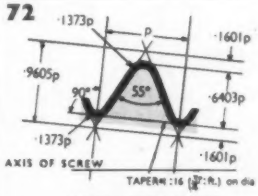
METRIC FINE 50°
France E27-011

71



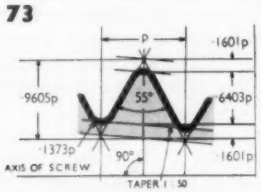
American
LOK-THRED

72



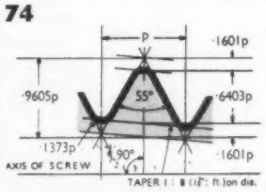
WHITWORTH TAPER
Germany DIN 4914

73



WHITWORTH TAPER
Germany DIN 4932

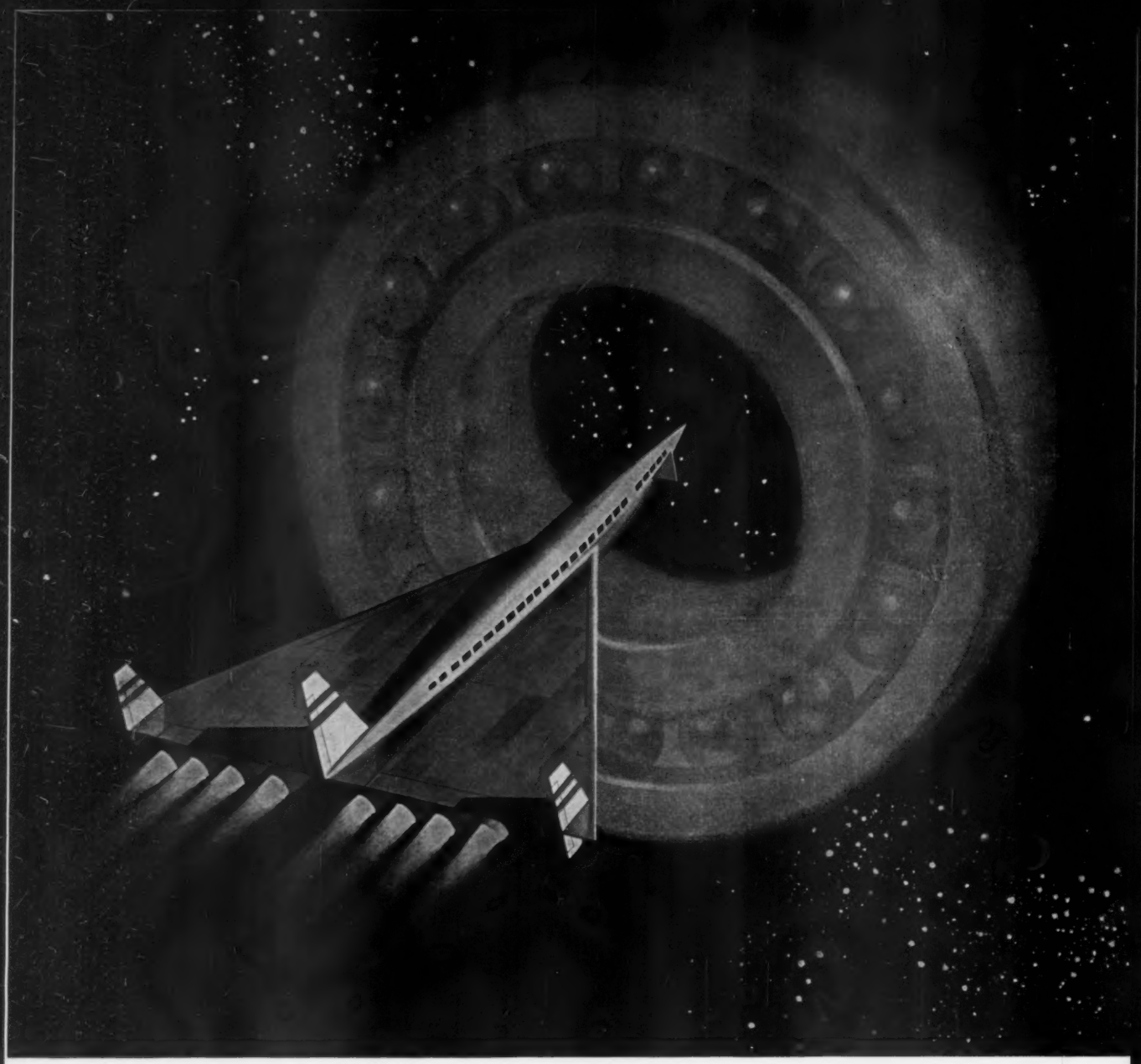
74



WHITWORTH TAPER
Hungary MNOSZ 3164

75

WOODSCREW



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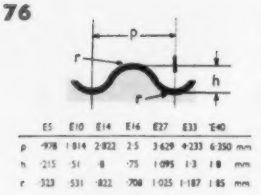
CIRCLE 319 READER SERVICE CARD

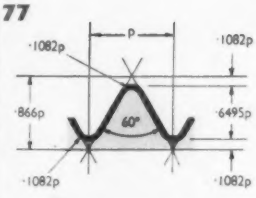
World Screw-Thread Forms—VI

76



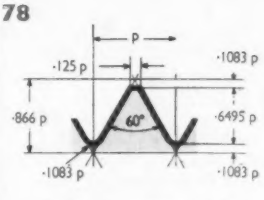
EDISON
(See Form 102 for E21)

77



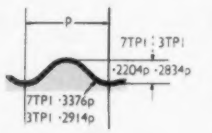
METRIC FINE
Germany DIN 41282

78



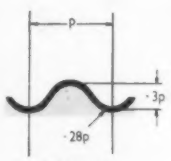
American Petroleum Institute
A.P.I. SUCKER ROD

79



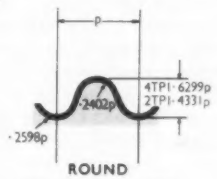
ROUND
Germany DIN 3182
Sweden SMS 680

80



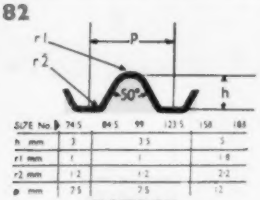
ROUND
Germany DIN 5396

81



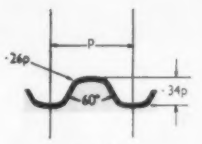
ROUND
U.S.S.R. Gost 3510

82



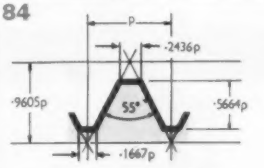
ELECTRICAL
Czech, Finland, Germany, Poland, Rumania, Switzerland

83



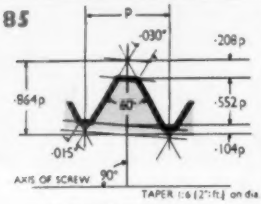
ROUND
Germany DIN 168/1
Czech CSN 01. 4081

84



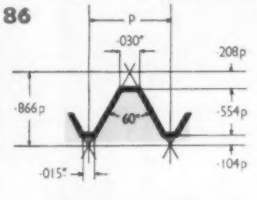
AMERICAN MICROSCOPE OBJECTIVE ASA B 1.11
(and former ASA B 1.6 Truncated Whitworth)

85



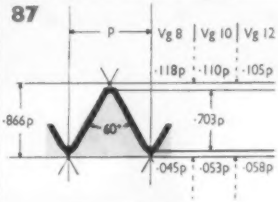
American Petroleum Institute
A.P.I. Piston Rod and Crosshead Extension
(Taper Section)

86



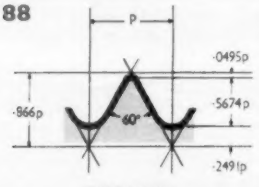
American Petroleum Institute
A.P.I. Piston Rod and Crosshead Extension
(Straight Section)

87



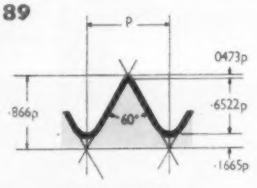
TYRE VALVE Vg 8 to 12
Germany DIN 7756

88



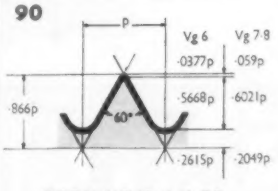
TYRE VALVE
Germany DIN 7756 (Vg 5)
Czech CSN 01.4083 (Vz5)

89



TYRE VALVE Vg 5·2
Germany DIN 7756

90



TYRE VALVE Vg 6, Vg 7·8
Germany DIN 7756

This series to be continued in future issues

A STOCK LEMPCO DIE SET HELPED H. K. METALCRAFT DO THE "IMPOSSIBLE"!

Winner of the John Woodman Higgins Award for 1961, Emil Loeffel, Metalcraft tool engineer, mounted his prize-winning dies in STOCK Lempco Die Sets, assembled to his order by a N. Y. City Lempco Distributor; see photos.

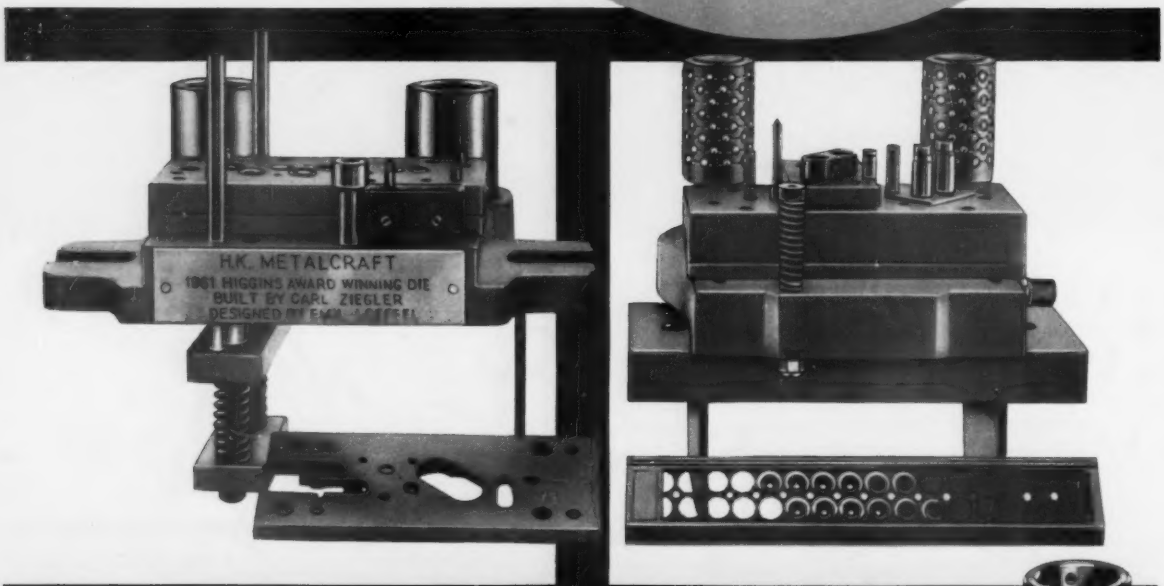
These dies produce, at $1.75 per thousand, a part which formerly cost $12 per thousand.

It was no accident that Lempco Die Sets were selected; Mr. Loeffel says he trusts their accuracy completely and adds, " . . . time saved in assembly and disassembly is very considerable".

Lempco Ball Bearing Precision Die Sets have long been known for this feature and for their ability to maintain exact alignment for millions of strokes, with an absolute minimum of maintenance. Why not find out for yourself all the advantages of using "prize-winning" die sets?

Lempco has a nation-wide warehouse organization. Write for literature and name of local distributor.

Photos Courtesy
H. K. Metalcraft
10th Ave. at 203rd St.
New York 34, N. Y.



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There's more to the buy than meets the eye

How do I know? We had a finish problem in reaming cast steel. Best finish we were getting was 150-175 micro-inch. We needed 60 or better. A W&B Service Engineer came in with one of their 1-1/16" Chucking Reamers. He checked feeds and speeds—finally came up with .011 per revolution and 60 SFM. He recommended a secondary grind on the chamfer to assure clearance, then added a second chamfer of 67°. We were able to get and maintain a reamed finish of 40-50 micro-inches. At the end of the day, the operator was getting all good parts and saving substantial time per piece. In a case like ours, W&B's technical help, service and consistent reamer quality really convinced me that initial price is merely one factor. Find out for yourself . . . test W&B tools in *your* plant under *your* conditions. Call them in direct or through your industrial distributor. Do it today. See if *you* can't get better results.

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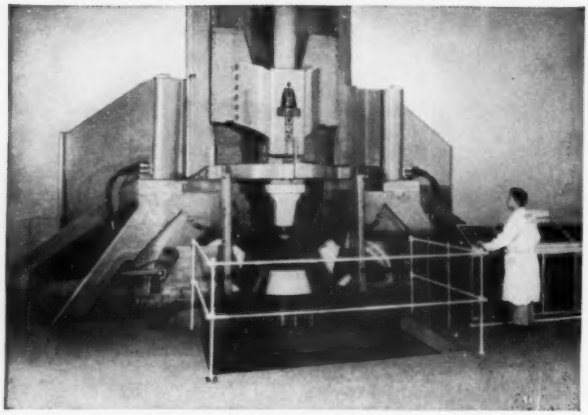
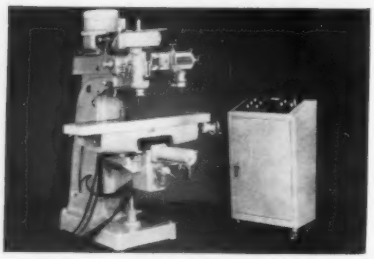


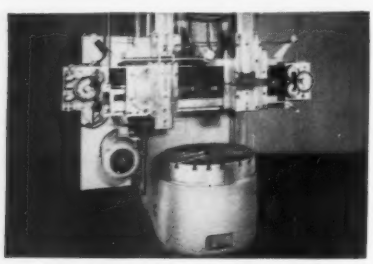
Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.



Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-7-61 Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

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Talking Shop

Cost Reduction Myths

SOME OF THE SHARPEST comment on "cost reduction programs" we've ever encountered was uttered recently. The comment came from Harvey Gittler, manager of manufacturing engineering at Underwood Corp and was reported by the Industrial Management Society.

Gittler says that Underwood has discovered some things that cost reduction *is not*:

1. Cost reduction is not a program. A program is something with a beginning and an end.

2. It is not cash curtailment. Programs usually start from a need to conserve cash flow. This is often necessary. But to confuse it with cost reduction "is one of the most serious errors that can be made and one of the most serious blocks to finding true cost reduction ideas."

3. Cost reduction is not a three-ring circus. It is not accomplished by getting everybody in the act. Underwood had a suggestion program that "saved " $115,000. It paid out $15,000 in awards, cost $60,000 to administer, plus cost of tooling changes and equipment.

Two engineers who had been working on the suggestion program were put to work on a real cost reduction idea. In one year they developed an indirect incentive system for the press department that is saving $100,000 a year.

4. Cost reduction is not confined to details. It is accomplished by management reviewing organization structure and policy, not by people at a low level whittling away at details.

5. It is not generating ideas. At one time Underwood had projects which—if and when completed—would produce $800,000 a year savings. "It took a lot of work, plus a fair amount of aggravation, until the engineering division convinced higher management that we didn't need help in idea gathering, we needed support and assistance in pushing the various 'projects on books' to completion."

6. Cost reduction is not being afraid of cost reduction. "If you are after big savings, make sure you are ready to take the necessary steps." A consultant showed a company how to save $750,000 a year in labor. Cost: $250,000 in salaries and fees one time. The findings were verified but the President was afraid of the trouble this bold change would make and turned it down.

7. It is not Yankee ingenuity, which Gittler defines as using baling wire to hold machines together that should have been thrown out 10 or 20 years ago.

8. Cost reduction is not seeking outside sources to do management's internal job. Consultants are helpful to improve techniques and to provide guides in special skills, but it is not cost reduction to use them to do management's internal job.

Cost Reduction Gains

FROM HIS CONSIDERATION of what cost reduction is *not*, Harvey Gittler goes on to consider what it *is*. Underwood established a methods engineering department. This section is independent of process engineering and is not bound by production schedules. This department has abandoned the conventional part-by-part analysis and takes a functional approach.

In one year production costs at Underwood were reduced 4%—about $1,000,000. And, says Gittler, these are *permanent* reductions through improved methods without a loss in performance, control, or in quality of product.

Surprise

THE SEARCH for a way to eliminate the cast-iron liner in aluminum cylinders continues. Did you know that it has been done in one small engine of which more than 10 million are in use? N W Smith of Alcoa told the SAE Summer Meeting that the bore is a 13% silicon alloy of aluminum. The pistons are chrome plated. Turns out to be much easier to coat the piston than the bore.

Sign Language

PEOPLE WHO ARE DEAF have unusual powers of concentration, and hence excel in the tedious detail work of electronics assembly. This has been a factor in choosing some 40 people for this work on the Agena satellite and Polaris missile at the Lockheed and Space Div in Sunnyvale, Calif.

But it poses some special problems in training and supervision. Bill Williams, a young instructor in Lockheed's education and training department has taught himself the sign language used by the deaf. He has also made up new signs for technical terms, such as transistor, capacitor, and module.

Williams is teaching two special courses. In one, the deaf are taught manufacturing skills and electrical diagram interpretation. In the second, Williams teaches use of the sign language to those who can hear.

The program seems to be going over big at Lockheed with both workers and supervisors. Williams is now compiling a dictionary of his special signs for technical terms. •

Practical Ideas

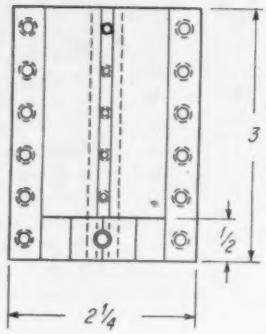
Special V-Block Aids Punch Grinding

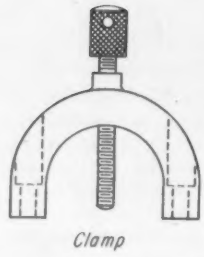
The special V block shown here is by far the most convenient and universal I have ever found for grinding punches. It can be made in various sizes, but the one shown here will cover most jobs very well. Several different lengths of liner blocks can be made up to cover any length or size of punch body.

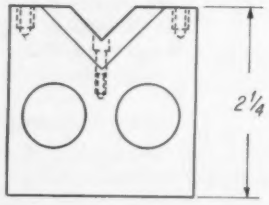
Several No. 5-40 holes are tapped in the ⅛-in. wide relief at the bottom of the main V block to accommodate the hold-down screws for the liners, which can be positioned and held where best suited for a stop, or as a riser to allow clearance for the punch head. A series of No. 10-32 holes is tapped along both top edges of the main block to retain the screws for the clamp.

The body and liner are made from machine steel, carburized, hardened, and ground to close limits. The Vee is ground exactly central with the sides of the body so flat and square punches can be ground without turning them in the Vee, thus producing a perfectly centered punch. The clamp screw is made from SAE 6145 or 6150 chrome vanadium steel and is hardened to Rh 50-54 C to resist wear. The end may be fitted with a non-rotating pad of the type commonly used on C-clamps to avoid marring the work.

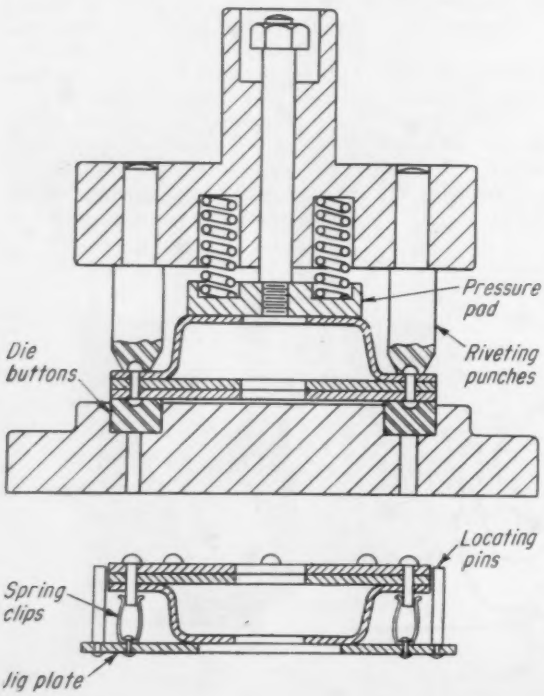
H M Sharfley, Jackson, Mich







Assembly Jig Speeds Riveting



We had to make up a large number of riveted assemblies consisting of two flat blanks and a drawn cup held together by eight rivets equally spaced. We decided to do this in a press, so all eight rivets could be headed simultaneously, but it was almost impossible to insert all the rivets through the three parts and keep them in place when we turned the work over to set it in the die. We therefore made up a simple assembly jig consisting of a flat plate with eight U-shaped spring clips and four locating pins. The cupped member is placed on the jig between the locating pins, the two plates laid on top, and the eight rivets pushed through the holes and into the spring clips. The complete assembly is then turned over and placed on the die buttons. The work is held down with one finger on top of the cupped member, and the jig is pulled off. It takes only about 10 or 15 seconds to assemble and load the die.

The riveting punches are inserted in a holder which also carries a spring-loaded pressure pad. When the press ram comes down, the pressure pad contacts the cupped part and presses the three parts tightly together before the punches head up the rivets. This ensures a tight fit all around.

The entire operation, including loading the jig and placing it in the die, is much faster and more convenient than trying to keep the rivet heads in the die cups and place the stamped parts over them.

A Hjalmar Dahl, Upplands Vasby, Sweden

Vacuum Chuck is Easily Made

This small vacuum chuck is easily made and is very useful for holding non-magnetic materials on a magnetic chuck. It can also be screwed to a lathe faceplate or used for layout work.

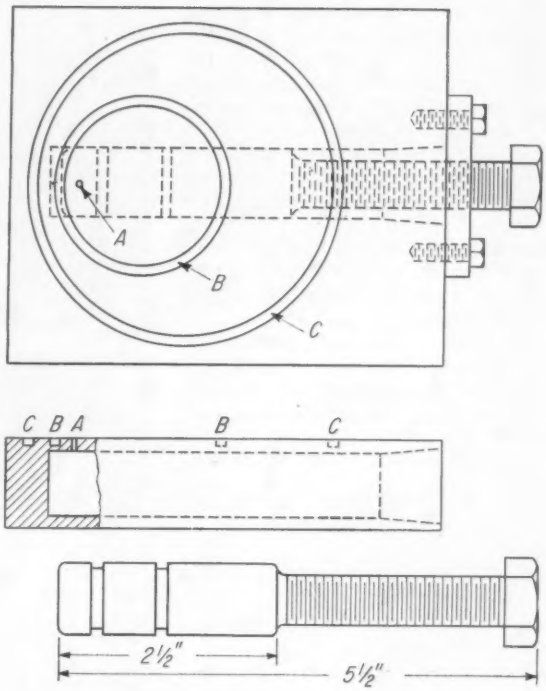
The body is a piece of machine steel about 4 x 5 in., and 1 in. thick. On the top face are two ring grooves to suit standard O-rings. The smaller groove has an ID of 1.859 and a width of 0.070 in. The larger ring is 3.489 ID and 0.070 wide. The depth of both grooves is 0.010 in. less than the diameter of the body of the O-rings. These dimensions may vary according to the rings available, but the width of the grooves should be 0.020 to 0.025 in. wider than the ring thickness.

An 0.750-in. hole is bored down the longer axis of the block to within half an inch of the bottom, and a No. 60 hole is drilled where shown. The bore is lapped to a smooth finish and is bell-mouthed to a 20° included angle for a depth of 1 in.

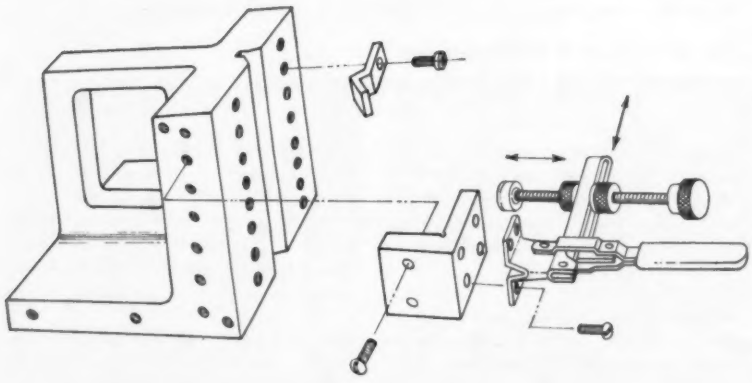
The plunger is 0.740 in. in dia and has two grooves for O-rings, ½ and 1¼ in. respectively from the end. The shank is threaded ½-20. A tapped plate is attached to the block to act as a nut and, after assembly, a standard nut is pinned to the end of the shank. The plunger should be greased, but the O-rings on the top of the block must be kept clean and dry.

When work is placed on either the large or small O-ring and the plunger screwed back, a tremendous holding power is generated.

Henry E Piltz, E Orange, NJ



Improved Toolmaker's Knee



The knee shown here embodies several features not found on commercially available types. The V-slot accommodates square bars, or rounds up to 1¼ in. in dia, and aligns vertically or horizontally. The toggle clamp may be attached directly to the knee, or offset by means of a bracket, as conditions require. It forms a quick-clamping arrangement when handling several pieces of the same size, and is readily adjustable by means of the thumb screw provided.

The small Vee bracket may be used as a stop for pieces having the same height, or to provide clearance for pieces with an integral collar. The square cutout in the center rib serves to provide clearance for strap clamps for holding the knee on a machine table. By fastening the clams over the face of the knee, it is possible to make layouts, inspect, drill, or work by rotating the knee through 360" (four positions) without interference from the clamp. If desired, the bottom may be milled out and a key installed to facilitate setups on tables equipped with T-slots.

The piece is a malleable-iron casting and is sturdy enough to be used as a fixture for machining. It measures 4 x 4 x 4 in. and is tapped ¼-20 as shown.

George A Spitz, York, Pa

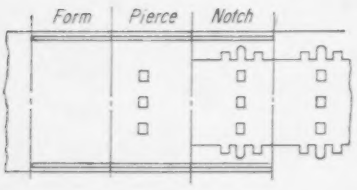
Practical Ideas

Ribs Stiffen Press Scrap

In stamping thin stock, 0.005 to 0.015 in. thick, we found that the long, narrow strips of scrap would curl up and jam the die. We tried air jets and push-off pins, but they would not work. Finally, we found a solution, as shown in the sketch.

We modified the die to include a station for forming a narrow rib about 0.010 in. deep close to each edge of the strip and within the scrap area. This stiffens the scrap and prevents it from curling up. We had to make allowance for the fact that the forming operation reduces the width of the stock, and we had to provide clearance on the heel of the notching punch. The rib, incidentally, is formed upward, not downward.

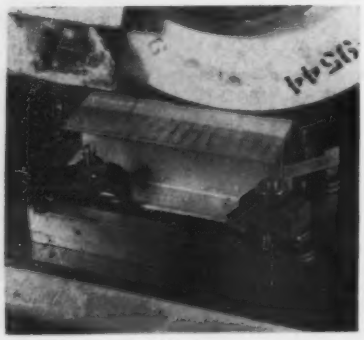
Benjamin Schneider, W Orange, NJ



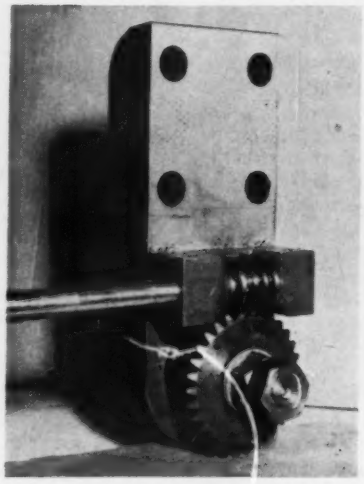
Auxiliary Platen Holds Nonmagnetic Work

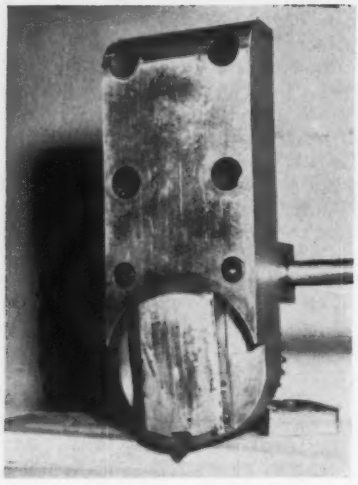
I have made up a small T-slotted steel platen which I use for mounting nonferrous work on the magnetic chuck of a surface grinder. Work is clamped to the platen, as shown here, then the complete setup placed on the magnetic chuck. The platen shown is for small jobs encountered in experimental work.

H J Gerber, Stillwater, Okla



Powered Toolholder Planes Radii





We had to machine some half-round bearings for a big crusher out of special castings weighing some 400 lb each. We did not have any suitable boring equipment, so we did the job on a small planer with this radius tool carried in the regular toolholder.

We disconnected the mechanical feed and connected it to the worm shaft by means of a ratchet arrangement so that, at each stroke, the worm is turned a small amount, rotating the tool by means of the worm gear. The single-point cutting tool is held by two setscrews.

John Epp, Winnipeg, Canada

MILLING FIXTURE DOESN'T NEED MILLING MACHINE—
Was the winning entry in the May 1, 1961 issue.

The $25 prize is awarded to:
HJALMAR DAHL, Upplands Vasby, Sweden

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

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WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Names in the News

Chicago Pneumatic Tool Co, New York, has elected **Carra L Lane** a vice president. Currently manager of plant operations, he will continue to supervise manufacturing operations of the firm's domestic plants

Taft-Peirce Manufacturing Co, Woonsocket, RI, has named **Richard V Freeman** assistant manager of machine tool sales. He was formerly direct sales representative in the eastern New England territory

Gleason Works, Rochester, NY, has named **John Somerset** a vice president. Mr Somerset joined the company in 1937 and has been sales manager for the past year

Raytheon Co, Waltham, Mass, has elected **Kenneth M Lord** vice president, manufacturing and purchasing. Mr Lord has resigned as vice president and general manager of the Military Products Division, General Dynamics Electronics, to take the newly created Raytheon post.

Koehring Co has promoted **David W Marchant** from president and general manager of Koehring-Waterous Ltd, Brantford, Ont, to president and general manager of Koehring Division, Milwaukee, to succeed **E A Brugger** who has accepted a new assignment abroad in connection with the company's overseas activities. **Kensal R Chandler,** assistant vice president of sales, Koehring Division, replaces Mr Marchant in Canada.

Chrysler Corp has announced three appointments in its Defense Group. **H Douglas Lowrey** has been named general manager, Defense Operations Division; **James C Smith Jr** is new assistant general manager, Missile Division; and **Lovell Lawrence Jr** has been made director, Advanced Projects Organization.

American Society for Testing Materials has elected as president for the coming year **Miles N Clair,** head of **Thompson & Lichtner Co,** Brookline, Mass. **Alfred C Webber** has been elected ASTM vice president. Mr Webber is assistant to the laboratory director, Research and Development Division of the Polychemicals Department, **E I du Pont de Nemours & Co,** Wilmington, Del.

(Continued on p 150)

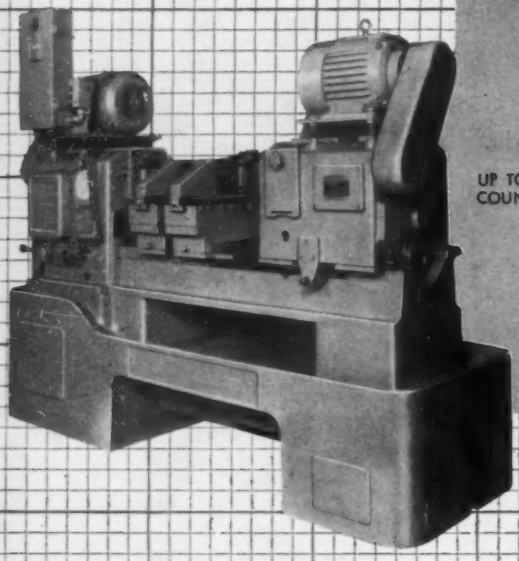
Harrington-Wilson-Daum Corp, New York machine tool distributor, has appointed **John P Finn** vice president in charge of its sales organization. Mr Finn has been associated with the company since 1947 and has been vice president and a director of the firm since 1956

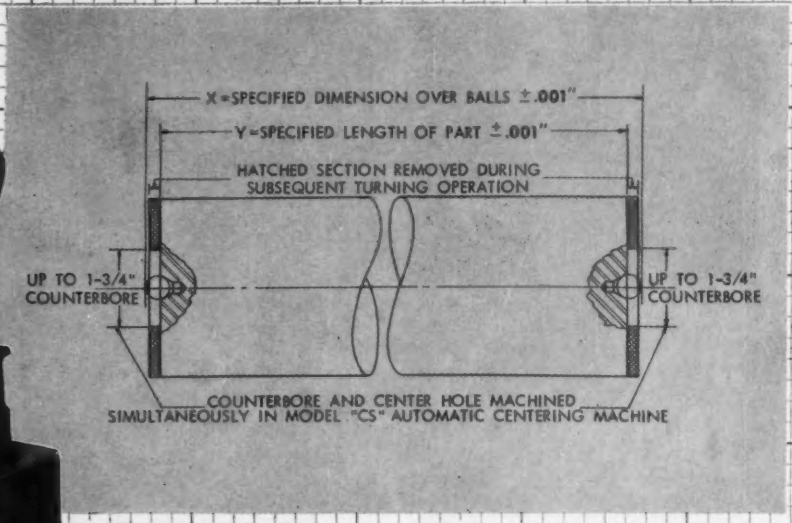
Reed Roller Bit Co, Houston, Texas, has appointed **R R Wright** vice president of the Cleco Air Tools Division. **Martin Hoza,** head of the division's R & D Engineering Department, succeeds Mr Wright as chief engineer

Van Norman Machine Co, Springfield, Mass, has named **Ralph Simons** assistant sales manager, machine tools. For the past three years Mr Simons has assisted George P Burns, vice president of the company, as sales office manager

Hughes Tool Co, Houston, Texas, has named **Arthur H Wooler** vice president, manufacturing, to succeed **Harry E Rogers** who has retired. Mr Wooler was formerly assistant vice president, manufacturing

IS INACCURATE CENTERING CUTTING YOUR PROFIT?




X=SPECIFIED DIMENSION OVER BALLS ±.001"
Y=SPECIFIED LENGTH OF PART ±.001"
HATCHED SECTION REMOVED DURING SUBSEQUENT TURNING OPERATION
UP TO 1-3/4" COUNTERBORE
UP TO 1-3/4" COUNTERBORE
COUNTERBORE AND CENTER HOLE MACHINED SIMULTANEOUSLY IN MODEL "CS" AUTOMATIC CENTERING MACHINE

Accurate centering of work to be turned or ground is a most critical first operation. Inaccurate centering piles up unnecessary costs in terms of rework time, rejects and inferior product quality.

A Seneca Falls Model "CS" Automatic Centering Machine equipped for simultaneous spot facing and centering not only guarantees perfect centering on a production basis but eliminates the need for purchasing expensive centering and milling equipment.

Model "CS" is a positive action, cam fed machine equipped with properly designed spot facing cutters. No longer will you need costly spring centers and endwise locators for subsequent turning operations.

Obtain the performance diagrammed above on a continuous high production basis. The crosshatched area will be removed during the turning operation where optimum horsepower is available.

Send some of your sample parts today. Let us spot face and center them as a demonstration of what this machine will do for you.

BUILT-IN FEATURES OF MODEL "CS" AUTOMATIC CENTERING MACHINE

- Positive control of center depth to ±.001".
- Accurate location of the work piece to assure correct center depth at both ends.
- Correct angle and perfect alignment of center holes.
- Double action feed cam to produce a smooth cleanly finished center hole.
- Quick change-over through pre-set graduated cams.
- Complete automatic cycle, 100% mechanical.
- Automatic work handling equipment available.

Write for Bulletin CS-60

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

Braeburn Tool Steel Hardens to Rh 70C, Stays Tougher, Grinds Easier Than T-15

Braecut, a new tool steel that can be hardened to Rh 70 C, is reportedly tougher than T-15 steel because it is considerably lower in carbon content. For maximum hardness Braecut contains 1.15% carbon whereas the carbon content of T-15 is 1.57% at Rh 68C.

Vanadium content of the new steel is also quite low—2.25% compared to 5% in T-15. The combination of low carbon and low vanadium makes Braecut as easy to grind as most ordinary high speed steels and has resulted in replacement of T-15 with Braecut in applications where Braecut bit life is not significantly better than T-15.

In most applications Braecut outperforms T-15 by a good margin and in at least one field test it outperformed carbide tooling. An anvil block made from .88 Mn-Cr-Mo steel at Rh 52C was machined with a Braecut 1-in. square bit without chipping after a carbide tool had shown chipping.

In machining 17-4 ph, 30, 304, 310, and Monel K stainless, Braecut bits were said to cut better than all other grades of tool steel and in turning AISI 1020 cold rolled, Braecut outperfromed T-15 by a ratio of 14 to 9.

Best hardness for Braecut is obtained by hardening from 2225F followed by double tempering at 1025F and a third draw at 950 to 1000 F. Maximum effectiveness is gained by double tempering before grinding and an additional temper after grinding.

Composition of Braecut is as follows: carbon, 1.15%; manganese, 0.25%; silicon, 0.25%; chromium, 4.25%; vanadium, 2.25%; tungsten, 5.25%; molybdenum, 6.25%; and cobalt, 12%.

Braeburn Alloy Steel Corp, Braeburn, Pa

MORE DATA? Circle 82, inside back cover

Low-Cost Plastic Caps, Sleeves Protect Shafts, Threaded Parts

Molded plastic caps and sleeves are available in large sizes at low cost even when quantity is small.

Caps are for protection of threaded shafts, machined shafts, or drill pipe. Made of Polyethylene, they provide a seal against dust and moisture and protect against impact damage during storage, process or transit. The caps can be furnished in several colors as well as translucent white.

Protective Closures Co, Inc, 2207 Elmwood Ave, Buffalo 23, NY

MORE DATA? Circle 83, inside back cover

Stretchable Polyethylene Tape Resists Water, Low Temperature

Pressure-sensitive polyethylene tape is elastic and resistant to water and many chemicals and solvents. The tape has an effective performance range of – 50 to 225 F and a sustained flexibility at low temperatures. Special backing paper allows easier handling and application in pre-cut strips and patches and prevents "telescoping" of the tape when it is being die-cut or stamped.

Prices start at $.79 per roll for 1-in. width in 1200-roll lots or more.

Fasson Products, 250 Chester St, Painseville, Ohio

MORE DATA? Circle 84, inside back cover

Release Agent for Plastics Doubles as Metal Lubricant

GS-3 release agent for molding, casting, laminating and foaming operations with plastics and thermoplastics is also said to be an excellent lubricant for bearings, tools closures, and bushings. Unaffected by water, oils and most chemicals, GS-3 is claimed to have twice the lubricating efficiency of graphite. It can be brushed, dipped, sprayed, or wiped on and can also be used as an anti-arc agent for coating electrical circuits and a release agent for paint spray booths, tanks, and chutes.

RAM Chemicals Inc, Gardena, Calif

MORE DATA? Circle 85, inside back cover

DIAMOND LAPPING COMPOUNDS available in disposable non-breakable plastic syringes are said to have greater cutting efficiency, uniform shape, and resistance to breakdown. Reason for this is a new process in which diamond particles are suspended in a special formula vehicle. Compounds are available in mesh and micron sizes for lapping down to ½ micron finish — *West Coast Diamond Tool Co, 403 No. Foothill Rd, Beverly Hills, Calif*

MORE DATA? Circle 86, inside back cover

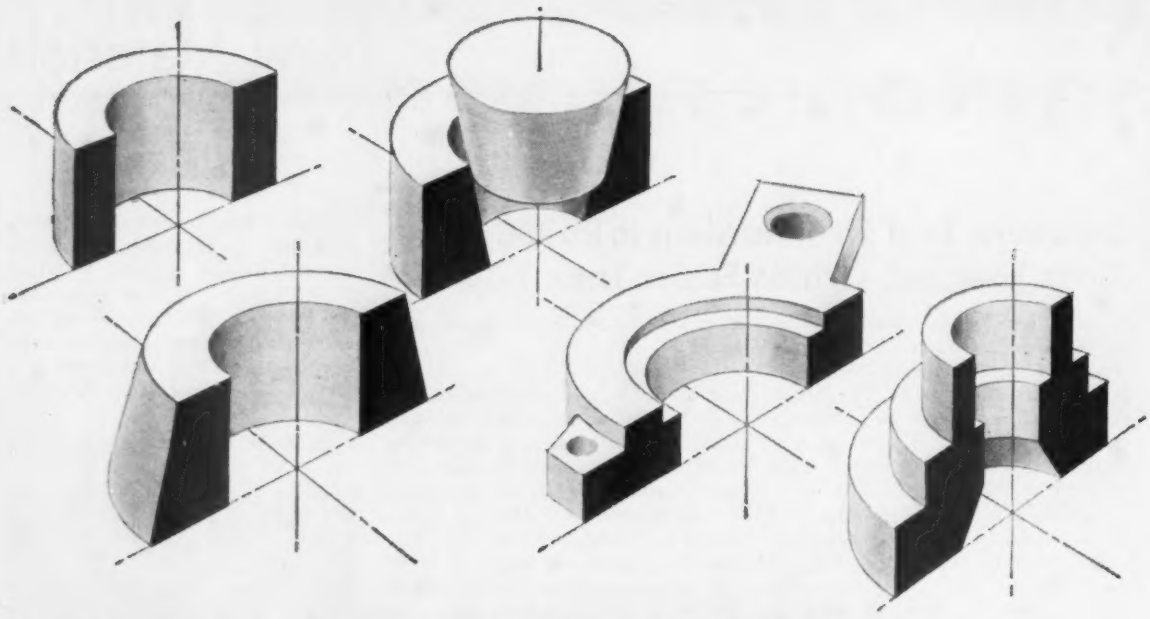
Tap Lubricant Smooths Finish, Ups Tool Life In Exotic Metals

Moly-Dee tapping fluid has for its basic ingredient, molybdenum disulfide, which is said to extend tool life and to produce finer work finishes when tapping, drilling, or reaming hard or exotic metals. The compound is thermally stable from —90 to 750 F, does not contain toxic vapors and is slow to evaporate, thereby reducing air pollution problems.

An adsorption agent known as OF 33 has been added to Moly-Dee; it is said to increase the lubricant's affinity for metals so that the compound clings to metal surfaces under pressures that are beyond the yield point of the metal itself.

Arthur C Wintrow Co, 5511 District Blvd, Los Angeles 22, Calif

MORE DATA? Circle 87, inside back cover



when to consider Vertical Grinding

A simple test you can try for yourself quickly determines whether you should consider the Springfield principle of *vertical* grinding. Try it!

CHECK YOUR ANSWERS TO THIS QUIZ	YES	NO
1. Do you grind holes 4" in diameter and larger?	☐	☐
2. Do you grind taper holes or mating parts?	☐	☐
3. Do you grind on irregular shaped work?	☐	☐
4. Do you grind O.D. or I.D. shoulders, offsets, undercuts?	☐	☐
5. Do you grind pieces requiring extreme concentricity?	☐	☐
6. Do you require a 5 micro-inch or better finish?	☐	☐
7. Do some of your grinding jobs require many setups?	☐	☐

If you answer yes to three or more questions, a Springfield vertical universal grinder probably can save real time and money in your plant. Mail the coupon today for your free and informative copy of "Vertical Universal Grinders"; Bulletin 197-F.

THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

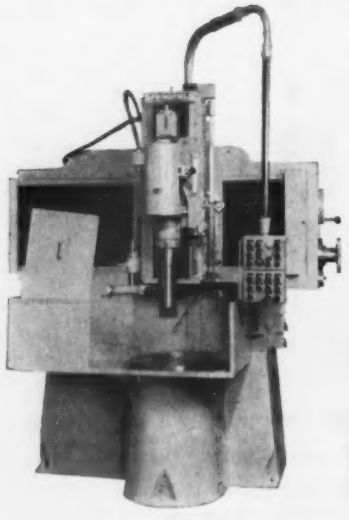
SPRINGFIELD

*name & title*_____

*company*_____

*address*_____

*city, zone, state*_____



Above is a standard Springfield 2A-TR vertical universal grinder. It swings 25"; the grinding head has a 21" stroke and it grinds holes to a nominal depth of 18". The head can be tilted 45° in either direction. Electro-hydraulic control is standard with pendant pushbuttons. The Model 2A-TR costs less than most horizontal chucking grinders of comparable size; it can do the same work plus a wide variety of jobs that just can't be done on a horizontal. Gravity works for you in vertical grinding.

Quick-Drying Synthetic Rubber Adhesive Bonds Porous Material

Fast-drying synthetic rubber adhesive known as Bostik 1142 is said to allow parts assembly within two to five minutes after application. It is recommended for adhering to a variety of materials, among them steel, aluminum, glass, neoprene and especially, porous surfaces such as sponge rubber and sponge urethane.

The adhesive is pinkish tan in color, has a solids constant of 28 to 30% and the consistency of a thin syrup. Bostik solvent or MEK may be used as thinning agents.

Bostik Dept, BB Chemical Co, 784 Memorial Dr, Cambridge, Mass

MORE DATA? Circle 88, inside back cover

Worm-Gear Lubricant Gives 25% Decrease in Efficiency Loss

Dynomometer tests with Conedroil A and Conedroil B show up to 25% decrease in efficiency loss. The lubricants, which have a combination of fatty and chemically-combined EP agents, are said to combine exceptional wetability and extreme pressure characteristics with excellent natural lubrication and a high viscosity index.

Conedroil A gives lubrication exceeding AGMA No. 8 and 8 A requirements and Conedroil B exceeds AGMA No. 7 lubricating requirements.

Shear-Speed Chemical Products, Div Michigan Tool Co, 7125 E McNichols Rd, Detroit 12, Mich

MORE DATA? Circle 89, inside back cover

3M Introduces Four Printed Circuit Board Adhesives

Four new liquid synthetic resin base thermosetting adhesives for bonding copper foil to phenolic or epoxy impregnated stock, phenolic paper, epoxy paper, or epoxy glass materials have been developed to meet the special requirements of these processes.

Adhesive EC-1857 is designed for bonding untreated copper foil to epoxy or phenolic-impregnated base stock. The bond can be immersed in a 450 F solder bath for 35 seconds or 470 F solder bath for 20 seconds without losing adhesion or blistering. Cured bonds have a peelback strength of 6 lbs per in. width on 1-oz foil.

Adhesive EC-1855 is designed for bonding treatment A copper foil to phenolic or epoxy impregnated base stock. The adhesive bond between the foil and base stock withstands immersion in a 500 F solder bath for 20 seconds and shows peelback strength of 10 lb per in width on 2-oz foil.

EC-2080 is for bonding treatment A copper foil to phenolic paper, epoxy paper, and epoxy glass material. The adhesive cures to a clear amber film and the bond withstands 500 F solder bath for 10 seconds. Peelback strength of cured bonds are 10 lb per in. width on 1-oz foil.

EC-2130 is the same as EC-2080 except that EC-2130 resists chromic acid solutions.

The materials are applied to copper foil with a roll coater in a 1 to 2 mil dry film thickness. The coated foil is then air or oven dried and bonded, under heat and pressure, to the base material.

Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 90, inside back cover

Phenolic Molding Material Has High-Temperature Resistance

RL 415, an asbestos, fiber-reinforced phenolic material with extremely high heat resistance has been used to replace fabricated laminate for textile brake pads with spindles rotating at 20,000 rpm at a torque of 20 in.-oz. It is produced by the beater method for homogeneous blending of fiber and resin and is easily molded into flat or three-dimensional shapes. Besides its high heat-resistance the material is said to possess excellent dimensional stability and high strength.

Rogers Corp, Rogers, Conn

MORE DATA? Circle 91, inside back cover

Noble Metal Thermocouple Wire Has EMF Output of Chromel-Alumel

New noble metal thermocouple combination, Platinel, has an electromotive force output equal to Chromel-Alumel and a high degree of stability over an extended temperature range. Initial tests indicate a drift of two degrees in emf output after 2500 hr at 1300C.

The emf vs temperature characteristics of Platinel match those of Chromel-Alumel so closely that installation requires no compensating changes in instrumentation. In addition, Cromel-Alumel can serve as an extension lead wire for Platinel.

The wire is available in all sizes and is designated Platinel 1786 for the positive leg, and Platinel 1503 for the negative leg. As an alternate, Platinel 2, with twice the tensile strength of 1786 at high temperature, may be used for the positive leg.

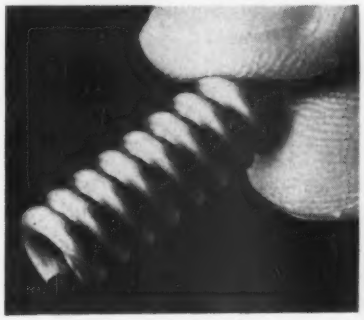
Instrument & Systems Section, Englehard Industries, Inc, 850 Passaic Ave, East Newark, NJ

MORE DATA? Circle 92, inside back cover

Stainless Spring Wire Exceeds Tensile Strength of Music Wire by 100,000 psi

NS-355, a stainless steel spring wire, shows tensile strengths in 0.075 in. dia size that are 100,000 psi higher than music spring wire. Guaranteed minimum strength of 0.195-in NS-355 is 290,000 psi compared to 245,000 psi for music wire of that size. Strength for 0.004 in. NS-355 is 500,000 psi as against 439,000 for music wire.

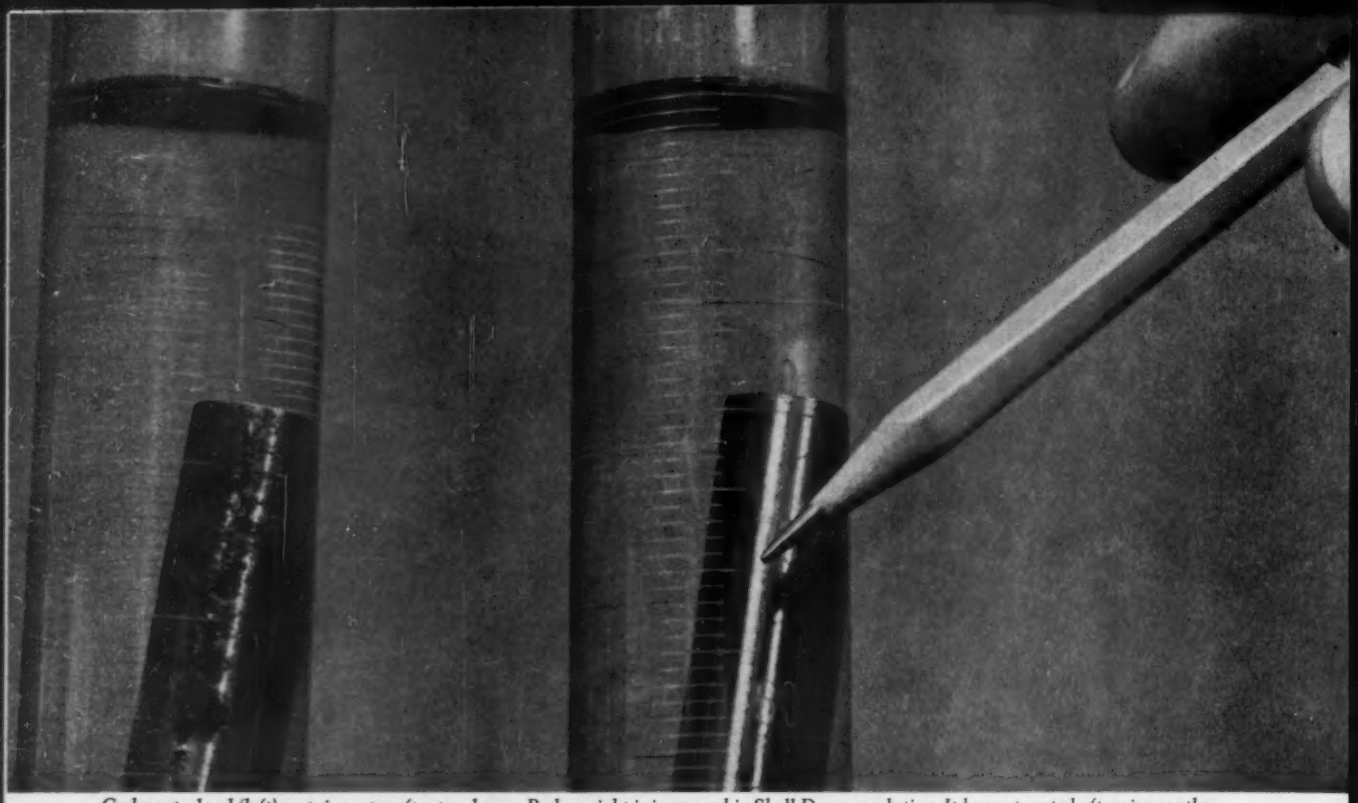
Tests using 0.125 and 0.075-in. dia NS-355 on automatic coiling machines show that a spring index of 3 can be achieved without breakage. The wire is suitable for compression and extension springs and hooking can be done without difficulty. NS-355 is an unbalanced semi-austinetic alloy with a typical analysis of; 0.142% carbon, 1.0% manganese, 0.027% phosphorous, 0.013% sulphur, 0.32% silicon, 15.65% chromium, 4.38% nickel, 2.68% molybdenum, 0.12% copper, and 0.124% nitrogen.



Modulus in torsion at room temperature is 11 to 11½ million psi, density is 0.282 lbs per cu in., and modulus of elasticity ranges from 29.3 million psi at 80 F to 24.6 million psi at 800 F.

The wire is available in diameters from 0.003 to 0.195 in. *National Standard Co, Niles, Mich* •

MORE DATA? Circle 93, inside back cover



Carbon steel rod (left) rusts in water after two hours. Rod on right is immersed in Shell Dromus solution. It has not rusted after six months.

REPORT:

Shell reports on ten features of Dromus Oils that can help you reduce cutting time and costs

THE Shell family of Dromus® Oils includes both solution-type and emulsifiable cutting fluids.

Each Dromus product has its own area of application—depending on water hardness, metal characteristics and specific job requirements. However, the entire range of Dromus Oils offers these ten benefits:

1. Dromus Oils are concentrates. They are designed to be mixed with the proper quantity of water at point of use for optimum results.

2. Dromus Oil emulsions resist foaming even under most severe conditions.

3. Dromus Oils contain an effective germicide. Result: less danger of rancidity and bacterial growth.

4. Dromus Oils do not separate. Even when mixed into emulsions containing more than 50 parts' water, Dromus Oils maintain their stability.

5. Dromus Oils prolong grinding wheel life. They prevent the wheel from "loading up" with metal from the work.

6. Dromus Oils provide effective corrosion protection for tool and workpiece. (See photograph above)

7. Dromus Oils permit greater dilution than many soluble oils.

8. Dromus Oils wash away metal chips with high efficiency. Chips then settle out of the emulsion.

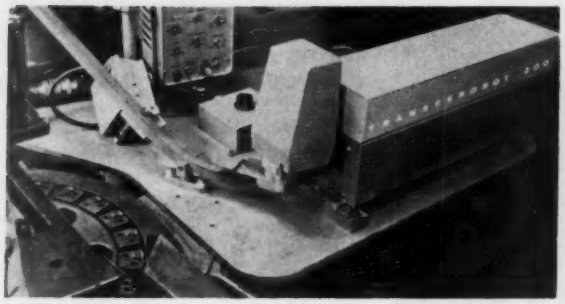
9. Dromus Oils can be kept in the machine during plant shutdowns.

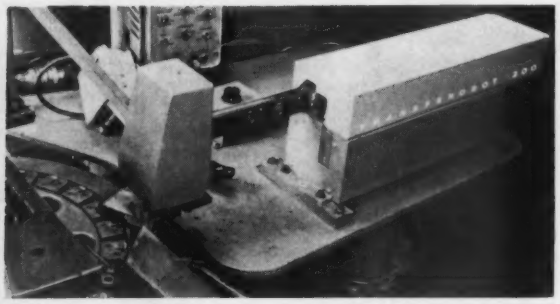
10. Dromus Oils are made under strict controls. Manufacture of Shell Dromus Oils is scientifically controlled.

There is a Dromus Oil for your cutting, sawing, boring, threading, milling or grinding need. Call your Shell Industrial Products Representative. Or write: Shell Oil Company, 50 West 50th Street, New York 20, New York.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry.





Robodyne Robot Gives Low-Cost Assembly-Line Automation

TransfeRobot 200, a low-cost automation device, consists of an arm and an actuator which can be fitted with several types of fingers and jaws, and a self contained electronic brain. The machine can use its fingers to seize, move and position a workpiece, and with the addition of an accessory swivel, it can perform operations that require "wrist" motion. The brain of the machine can command other machine operations as well as its own so that production line drilling, stamping, or assembly can be coordinated with the movements of the robot.

Examples of the machine's versatile operation include the above illustrations which show the robot on the Olivetti production line picking up a tiny component as it drops from a chute (left) and transferring it (right) to the nest of an automatic countersink machine. Westclox Co, uses the machine to oil a complete assembly as it passes on a conveyor belt. The machine oils eight bearings simultaneously in one second.

In another use the machine feeds parts to a trimming press in an automobile steering assembly production line, orders the press to cut off excess material and ensures that the finished parts are properly discharged from the press.

Programming the machine is reportedly so simple that the average foreman or setup man can learn to program it within an hour. In addition to performing a variety of operations, the machine can be set to flash lights or sound buzzers if something goes wrong with the work program.

Price of the robot is $2500, and the company plans to make it available on a rental basis as well.

Robodyne Div, U S Industries Inc, 12345 New Columbia Pike, Silver Springs, Md

MORE DATA? Circle 51, inside back cover

RayData Monitor Converts Pickup Signals to Relay Control Action

Series 18 operation monitors translate the amplitude and frequencies of signals obtained by pickup devices attached to machines into normal or off-normal indications.

Panel lamps indicate, and external relays operate to give limit signals at varying degrees of change from desired operating conditions. Internal logic elements convert selected combinations of these limit signals into normal, alert and alarm relay actions.

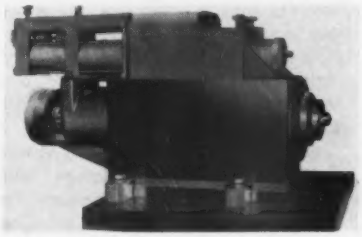
The instruments have a capacity of two data channels, each with two limit levels. These channels may be excited by two separate transducers or may be used to monitor two characteristics of a signal from a single pickup.

Signal levels and frequencies presented on panel meters may be calibrated in units of vibration displacement, velocity, acceleration, strain, peak pressure, and optical or sound levels.

Applications for the 12-vdc powered instrument include monitoring machine tool vibrations, bearing and balance conditions in pumps and material homogeneity inspection.

RayData Corp, Columbus, Ohio

MORE DATA? Circle 52, inside back cover

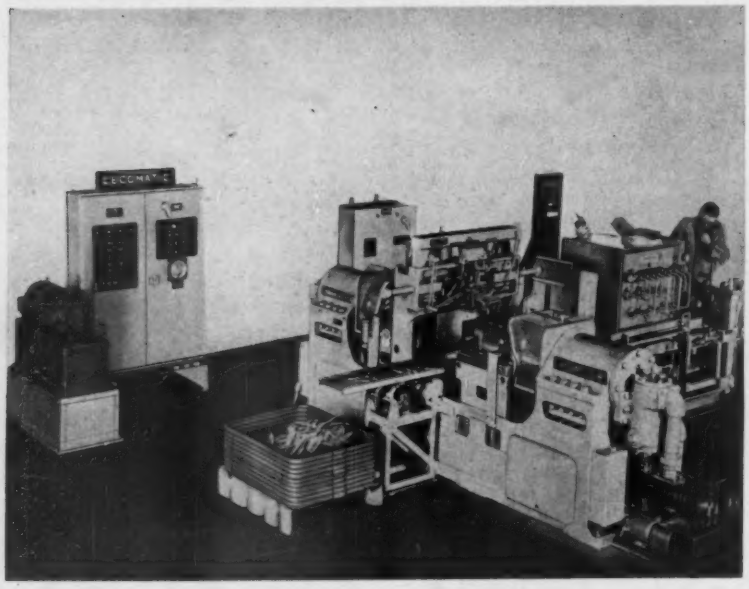


Miniature Boring Spindle Holds Travel Error to 50 Millionths

Miniature reciprocating boring spindle with up to 2 in. axial travel has exhibited a rotational error of less than 0.00003 in. and a travel error of less than 0.00005 in. in its entire range of travel. Equipped with micrometer depth control, it repeats to within 0.0002 in. with fast infeed, controlled boring feed, and dwell time all variable. Boring speeds range from 1000 to 15,000 rpm.

Whitnon Mfg Co, Route 6 and New Britain Ave, Farmington, Conn

MORE DATA? Circle 53, inside back cover



Cecomatic Forging Units With Horizontal Impacters Speed Production, Reduce Shock

Higher production rates, less scrap and reduced shock of forging operations are advantages claimed for the Cecomatic horizontal-hammer forging process.

The horizontal hammer, called the Impacter, has striking rates that are reportedly much greater than those of ordinary hammers. In addition, since the faces of the dies are vertical in this setup, scale removal is easier. Head room is reduced substantially by the horizontal arrangement and vertical shock is eliminated. Therefore, heavy structural bracing and high ceilings are not needed in buildings that house the machines.

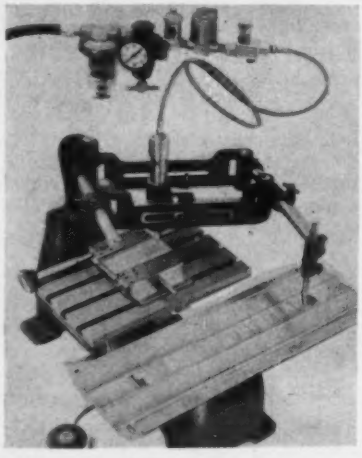
The Cecomatic process is offered as an integrated production unit complete with a gas fired furnace for heating cut lengths of bar stock. The process may be incorporated into a shop already equipped with automatic heating or it may be manually loaded by an operator who transfers the heated stock to the loading point.

Stock is manipulated through the various die impressions by fast moving tongs that are controlled by a programmed feed device. This device, which can be tape, card, or manually controlled, locates the stock with close tolerances in the stop and forging position and can also rotate it between Impacter blows.

Three sizes of Cecomatic units are available. They cover a range of drop forgings usually made in gravity drop hammers from 1,000 to 3,000-lb falling weight.

Chambersburg Engineering Co, Chambersburg, Pa

MORE DATA? Circle 54, inside back cover



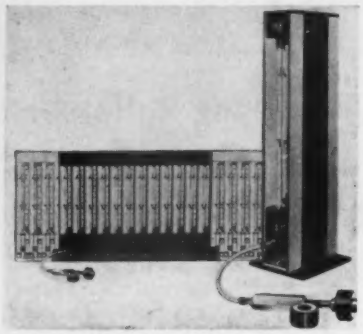
Attachment for Panto-Engraver Gives Even-Depth Marking Cuts

New panto engraver with pneumatic attachment for diamond drag marking is said to be the best method for pantographically marking on hardened steel, tungsten carbide and all non-ferrous metals. With the penumatic attachment, depth or width of the cut is controlled by the air pressure selected on the pressure dial which has a range of 0 to 60 lb. Controlled air pressure assures an even depth of cut since the marking is not subject to variations of hand pressure.

The attachment, which consists of a marking spindle unit with air cylinder and an air pressure control unit completely assembled, will fit all Preis panto engravers except model 2D-4.

HP Preis Engraving Machine Co, 204 Industrial Branch, U S Highway 22, Hillside, NJ

MORE DATA? Circle 55, inside back cover



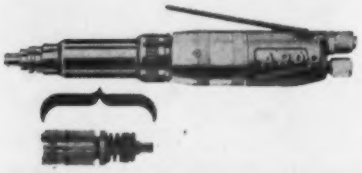
Air Gages Can be Grouped Into Multiple Systems

Air gage for bench-type and automatic inspection systems can be grouped into multiple systems that can be expanded at will and at low cost. Four ranges of amplification are provided with 10-in. linear scales and a complete line of tooling is available for gage use. The tubes are springloaded for ease of change and the floats are captive in the tube and cannot drop out.

Design of the individual columns is such that spare tubes and scales can be stored within the case.

Radio Corp of America, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich

MORE DATA? Circle 56, inside back cover



Air-Driven-Screwdriver Clutch Prevents Torque Limit Overrun

Torquematic clutch for air-driven screwdrivers and nutsetters has two cams that open instantly when a preset torque is reached. A separate

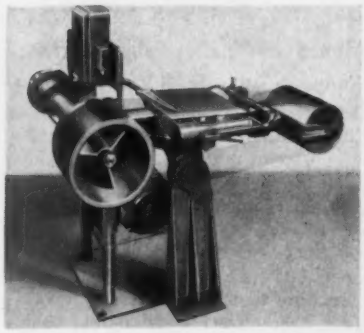
lockout cam also thrusts three lockout pins out to keep the clutch disengaged until pressure on the work is released, when it reengages instantly. This feature is said to positively prevent overrunning the threaded fastener.

Because there is no impacting action to cause work spoilage, the clutch can be used on highly delicate screwdriving and nutsetting jobs and, in addition, operation is quiet because there is no ratcheting.

The clutch is interchangeable with the clutch and housing on any Aro 0-series C-model tool. No adapters or special tools are required.

Aro Equipment Corp, Industrial Div, Bryan, Ohio

MORE DATA? Circle 57, inside back cover



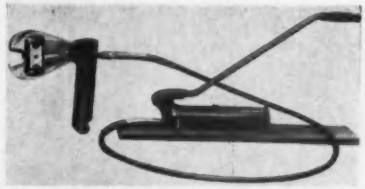
Positive Belt-Tracking Backstand Designed for Heavy-Duty Work

Model, suitable for use in deburring, surfacing, squaring, grinding, and polishing, may be driven by a lathe wheel or any other powered wheel. When heavy work pressures act to move the belt to one side or the other, an "air eye" signals the idler roll which automatically corrects position of the belt.

Units may be mounted in a number of different ways; when bracket-mounted on a standard Murray-Way L-10 or L-12 lathe, they may be quickly adjusted to any position from vertical to horizontal. They can be mounted on one of the company's standard buffing heads or may be adapted for use with any lathe by means of special M-W floor mountings. When backstand is vertical, workpieces can be hand positioned or conveyorized under the drive wheel, providing semi-automatic operation. Machines are available in two models for use with 6 or 12-in. abrasive belts. Minimum belt length is 114 in.

Murray-Way Corp, PO Box 180, Birmingham, Mich.

MORE DATA? Circle 58, inside back cover



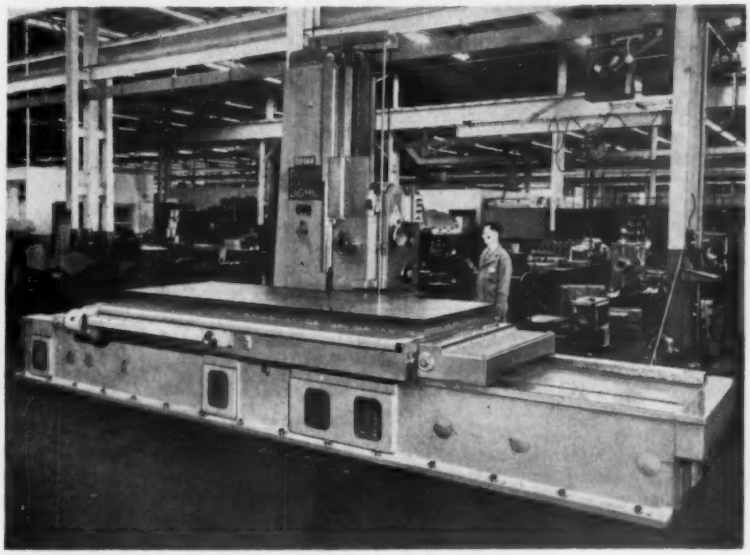
Hand-Hydraulic Cutter Cuts Metal on the Job

Model 1790CD combines a heavy-duty Porter center-cut cutter head with hydraulic power. It can cut soft metals through ¾-in. dia and medium-hard metals through ⅝-in. dia, such as concrete reinforcing rods, brass, copper, aluminum, steel, iron, and plastics. The unit is completely independent of outside power sources and can be taken to the job in the plant or outside in the field. It will operate overhead, on the floor, and in confined areas.

These units are powered by fast-acting, remote-control, hand-hydraulic pumps that force hydraulic fluid through high-pressure hose to the ram assembly and deliver 25,000-psi pressure on the cutting edges of the blades. A by-pass valve, two filter screens, plus a magnet in the pump prevent damage from overloading.

H K Porter Inc, Somerville 43, Mass

MORE DATA? Circle 59, inside back cover



DeVlieg Horizontal Boring Machine Has 12-ft Horizontal, 6-ft Vertical Travel

Called the 5H-144 Spiramatic Jigmill, this new 37-ton horizontal boring machine has a 5-in. spindle and a 24-ft bed that is flat within tenths. The bed also has a basic accuracy of 0.0001-in. per ft for straightness and alignment on all working surfaces.

Vertical movement of the spindle head in the machine column is 6 ft and its 50-in. wide table provides for 12-ft travel horizontally.

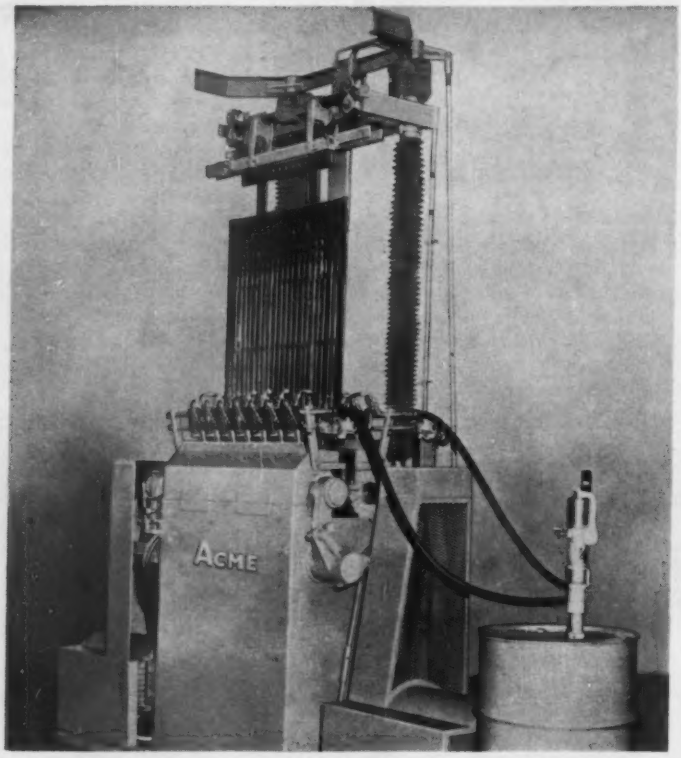
Diatrol, a dialing-in system of point-to-point dimensioning and positioning, which allows coordinate dimensions for horizontal table movements and vertical action of the spindle head, is furnished with the machine. Also adaptable is Tapac, a numerical control system with a master measuring bar controlling horizontal and vertical slide movements and point-to-point measurement positioning of horizontal and vertical slides. Tapac works with standard 1-in, 8-channel binary coded, punched plastic or paper tape.

Power to the machine's spindle is provided by a 20-hp motor through sliding spiral clutch gears. These allow disengagement of the driving clutch without disengagement of the driving gear itself. Range of spindle bar travel is 24 in.

Optional features include a thermal control system for the main spindle, a depth control attachment, which is an aluminum turret with 24 adjustable stops, and stainless steel way covers.

DeVlieg Machine Co, Royal Oak, Mich

MORE DATA? Circle 60, inside back cover



Acme Vertical Buffer Finishes Both Sides Of Irregular-Shape Parts Simultaneously

This vertical polishing and buffing machine simultaneously finishes both sides of flat, angular, or irregularly-shaped parts that are up to 48-in. long and 36-in. wide. In addition, if parts are 18-in. or less in width, two or more parts may be finished at the same time, or, if only one side of a part needs finishing, two parts can be set up back-to-back to double production speed.

The machine consists of a working head that reciprocates a part-holding fixture both vertically and horizontally between two rotating abrasive or buffing rolls. The part is reciprocated horizontally to eliminate streak marks on the finished work.

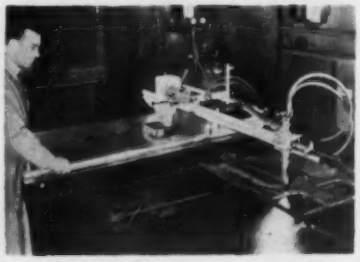
For irregularly-shaped parts, a thin hardwood cam shaped to the part contour controls the movement of the rolls to follow the part contour and provide an even polishing pressure over the entire surface.

Removable fixtures, which can be either manually set into the machine or located on a merry-go-round conveyor system for manual or automatic positioning, hold the parts. The conveyor system can connect several machines or can provide transport to loading and unloading areas.

Other features include an automatic cycling device for presetting the number of finishing strokes, a preset color selector for adding a coloring operation, and manual or automatic addition of buffing compounds through fixed spray guns or reciprocating gun movers.

Acme Mfg Co, 1400 E Nine Mile Road, Detroit 20, Mich

MORE DATA? Circle 64, inside back cover



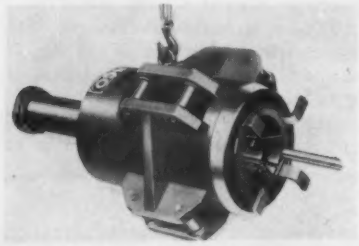
Low Cost Metal-Cutting Machine Designed for Small Workshops

Type RM1 portable oxycutting machine costs less than $1000 and can be operated safely by unskilled labor, according to manufacturer. Applications include automatic production work from steel templets; square or bevel-edge straight line cutting; hand-guided cutting; compass-guided circular cutting.

It will make longitudinal or transverse cuts of up to 50 and 30 in. respectively and will produce compass-guided circles with radii from 2⅜ to 15¾ in.

National Cylinder Gas Div, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill

MORE DATA? Circle 65, inside back cover



Manco Hydraulic Tube Pointer Reduces Tube OD 30% in 2 Sec

Model MTP-2500 hydraulic guillotine tube pointer reduces the outside diameter of a tube 30% in two seconds. It can be used for non-ferrous tubing with diameters ranging from ½ to 2¼ in. without changing pointed segments; only the radius segments are changed, with the average time for change being two minutes. Two links couple the die holder to the outer housing to guide both the segments and the die segment holder. This reduces downtime and twisting on off-center loads.

Manco Mfg Co, Bradley, Ill

MORE DATA? Circle 66, inside back cover

PRECISION SHAFT ADAPTERS are designed to convert tapered or odd-dimensioned motor shafts to the use of ¼-in. standard bores or couplings. Machined from No. 303 stainless steel with clear passivate finish, the two-piece adapters give a 0.2497 standard shaft on tapered shaft motors—*PIC Design Corp, 477 Atlantic Ave, East Rockaway, Long Island, NY*

MORE DATA? Circle 67, inside back cover

50,000 FEET UP

V-R Carbides are used to machine the aircraft metals that withstand twice the speed of sound. Cutting tool inserts, made of V-R Carbide, are doing an outstanding job on tape controlled milling machines producing superalloy components for Republic's all-weather, Mach 2, F-105 Thunderchief — the world's most powerful one-man airplane.

V-R FIRST CHOICE of more and more industries

V-R Carbides are used to resist wear deep in the earth where oil well drilling is the toughest. Mud nozzles, made of superior abrasion-resistant V-R Carbide, are hard at work — increasing drill bit life, reducing down-time and speeding progress.

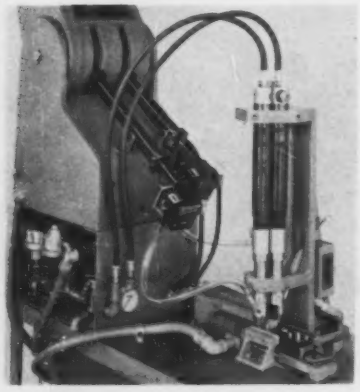
25,000 FEET DOWN

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

816 MARKET STREET • WAUKEGAN, ILLINOIS

C-840



Dual-Spindle Screwdriving Machine Cycles Automatically

Two air-fed screwdrivers with Tru-Tork nose pieces and a special double-track oscillating hopper are incorporated in the new Tru-Tork automatic screwdriving machine.

In operation, a shuttle type fixture pushes a part into position where it is held by a nylon pressure pad. When the part is centered under the driving head, a limit switch is contacted which initiates the screwdrivers. Screws are simultaneously metered and driven while the operator positions the next part on the fixture. This automatic cycle eliminates handling of screws and tool as well as manual buttons so that operator's hands are free to load fixture. Completed parts automatically drop into a chute.

The machine uses normal shop air pressure to operate the driving heads and 40-lb pressure to operate the metering device that feeds the screws.

Clyde Engineering & Mfg Co, 937 E 10 Mile, Madison Heights, Mich

MORE DATA? Circle 68, inside back cover

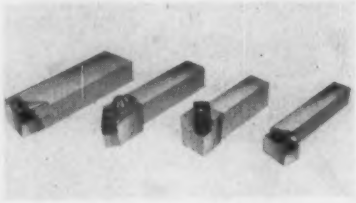
Tension Control Wrench Offered in Two Models

Air-powered tool reduces assembly costs because fasteners are used to their designed capacities. Special nuts and washers are eliminated. Build-in standard control permits adjustment to obtain tension from 25 to 100% of the elastic limit of the bolt. This clamping force is so great that accurate bolt tension is attained regardless of such variables as burrs, irregular threads, rust, scale, or other foreign elements. With the tool running in forward position and with adjusting screw set on low, the desired energy output is obtained by the tension adjustment. Different bolt sizes may be handled by loosening the setscrew and repeating the adjusting procedure.

Model 18B-7T has rated capacity of ¾ in., Model 18B-9T, 1¼ in. Capacities will vary according to material and tension required.

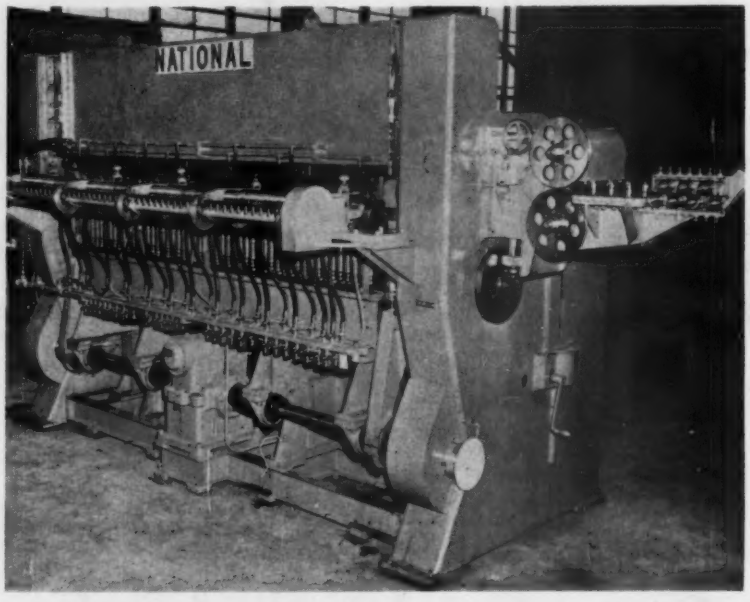
Gardner-Denver Co, Quincy, Ill.

MORE DATA? Circle 69, inside back cover



DESIGNED FOR USE in Warner and Swasey chuckers, bar automatics and turret lathes, these throwaway insert turning tools include six different holder styles that take square, diamond, and triangular shaped inserts. Each style is available in two or more sizes. Features include adjustable chipbreaker, low profile, short overhang, and carbide shim seats—*Valenite Metals, Division of the Valeron Corp, Box 205, Royal Oak, Mich*

MORE DATA? Circle 70, inside back cover



Fabric Welder Straightens Wire, Welds and Trims Fences or Light Mesh Automatically

High output automatic fabric welder produces fencing, utility fabric and light paving mesh in a working range of 2 to 12-in. spacing on wire of 4 to 10 gage. The unit consists of a wire straightener, welder trimmer, slitter, indexing device and coil winding reel.

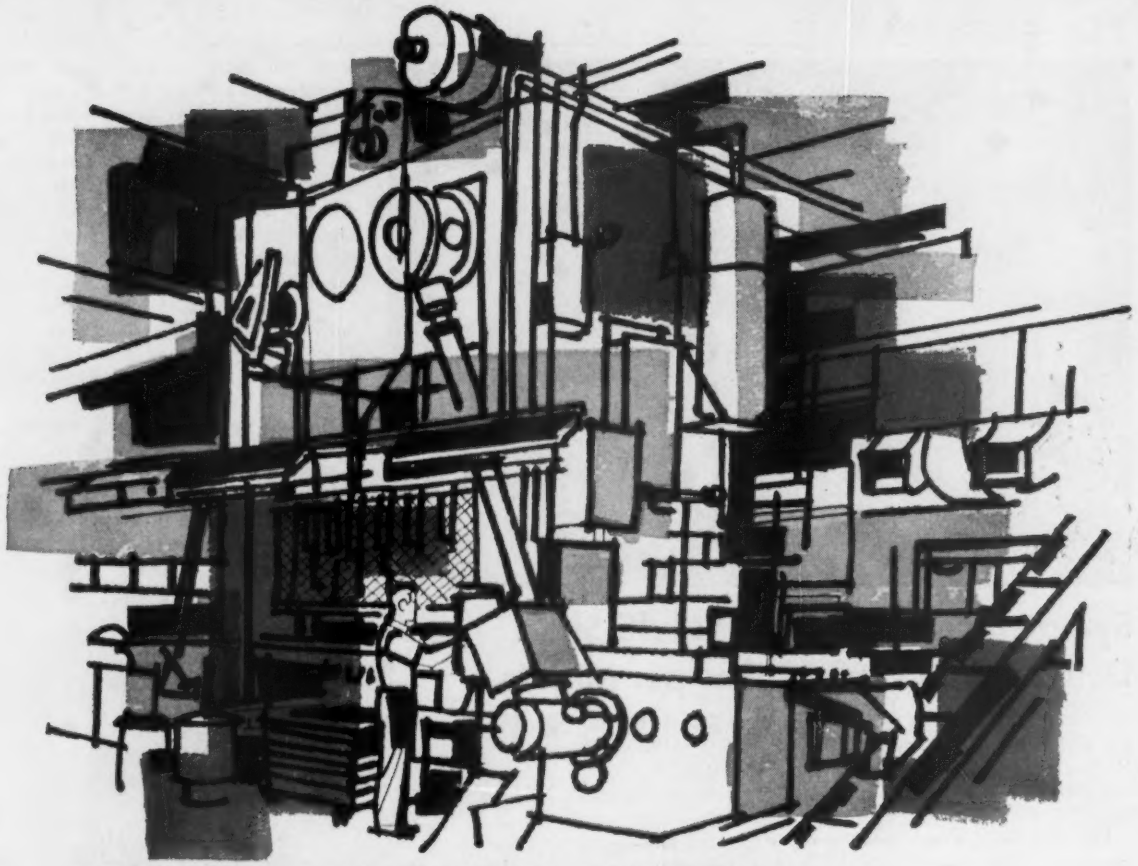
The single-head welder is fitted with 50 welding guns coupled in series to 25 15-kva transformers. Indexing mechanism combines a fixed pullout point with an adjustable stroke set with a hand crank. Cross wire spacing is also set with a hand crank.

Automatic adjustments include line wire spacing and straightening, cross wire feed and welding, and coil winding speed of the 36-in.-coil-dia divided mandril for coiling welded fabric.

Maximum material width that the machine can handle is 8 ft. and production rate is 70 strokes per min.

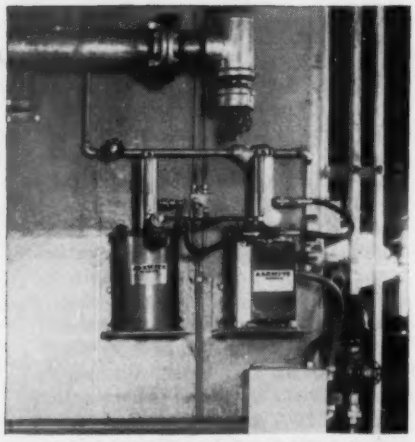
National Electric Welding Machines Co, Bay City, Mich

MORE DATA? Circle 71, inside back cover



ALEMITE ACCUMATIC SYSTEM LUBRICATES 300-TON PUNCH PRESS

Automatically...in seconds!



An Alemite Accumatic Centralized Lubrication System lubricates the key points on this 300-ton, 20-foot high Punch Press which can produce 1200 completed stampings per hour at 25 strokes per minute, based on 80% efficiency.

Complete with pump, metering valves, supply lines and controls, this Accumatic system offers all these advantages: It automatically meters out the exact amount of lubricant needed at each bearing on a predetermined cycle . . . never over- or under-lubricates. Guarantees lubrication of those out-of-the-way bearings frequently overlooked; protects against bearing wear due to neglect. Services *all* bearings in a single operation . . . in seconds . . . while the machine is running eliminating work stoppage . . . adding production hours to each day.

This installation is typical of the versatility and wide range of Accumatic's precision lubrication . . . typical of how Alemite's experience and products work together to provide the right lubrication system for machines of all types and sizes. Today, find out how Alemite and Accumatic can do a *big job for you,* too! *Send for free illustrated literature . . . or contact your Alemite representative.*

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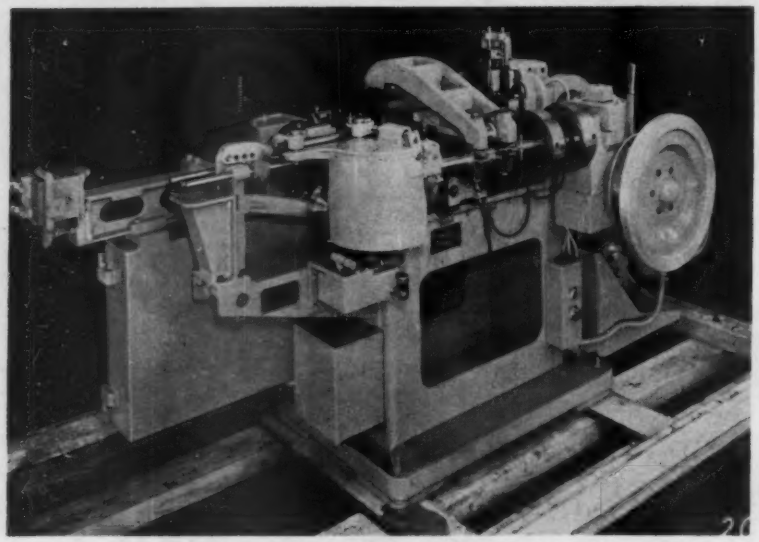


Symmetrical High Speed Multi-Slide Delivers up to 400 Strokes per Minute

With outputs of 400 strokes per minute attainable, the model MS-28-HS Multi-Slides are designed to reduce the piece part cost of formed stampings.

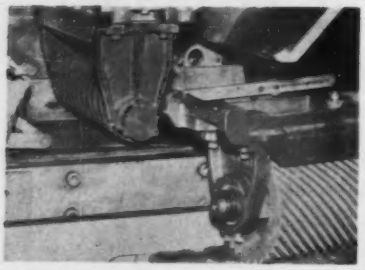
Die heads on this machine are reversible and can be used from either front or back. The machine also features a newly developed positive grip-type feed.

Standard equipment includes one complete die head with cam; back plate; tie bar; four high forming slides with cams; stripper mechanism with cam; stock check; stock straightener; and 5 hp variable speed drive withoutput from 80 to 400 strokes per minute.

The MS-28-HS will use the same tooling as the standard No. 28 symmetrical Multi-Slide. Feed for the high speed model is 8 in., maximum width of stock 1½ in., and maximum thickness of stock 1/16 in.

U S Tool Co, Inc, Ampere, NJ

MORE DATA? Circle 72, inside back cover



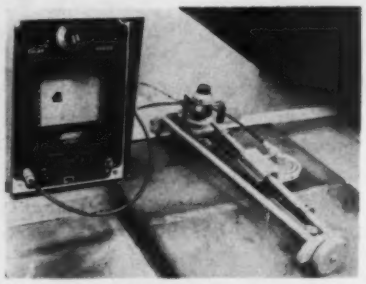
3-in.-dia Contact Wheel Speeds Rough Grinding Operations

Rough grinding operations can reportedly be done faster with a new wheel developed for use on the Tri-Matic oscillating belt grinder. Because the contact wheel is not the driving wheel on the Tri-Matic, it is possible to use a smaller diameter in place of the regular 7-in. wheel.

The 3-in.-dia wheel reduces the arc of contact between the abrasive belt and the work, resulting in faster, cooler cutting. The wheel is furnished in a mounting which replaces the 7-in. unit and mounts in minutes without extra adjustments. The same belts can be used because belt length is not changed.

Sales Service Mfg Co, 2363 University Ave, St Paul 14, Minn

MORE DATA? Circle 73, inside back cover



Branson Flaw Detector Inspects Welds With Reflected Sound Waves

The Sonoray 5 sends bursts of sound into a welded plate and picks up any returning echo to determine flaws in the weld. If the metal has a flawless weld, the pattern on a cathode ray tube shows a series of pyramid markers, which are an exact replica of the bouncing sound beam within the plate and weld. However if the sound wave meets any obstacle such as a slag inclusion, lack of fusion or hairline crack, some of the energy will be reflected and a large dot will be generated on the scope at the exact flaw location. If the transducer is moved to cover the flaw area, an exact picture of the flaw will be traced by a series of closely spaced dots on the screen.

The new flaw detector will find discontinuities as small as 1/16 in. and will safely check about 1 ft of weld per minute regardless of the number of beads or passes involved.

Branson Instruments, Inc, 40 Brown House Rd, Stamford, Conn

MORE DATA? Circle 74, inside back cover

Gas Scrubber Designed for Use In Many Industrial Processes

Impinjet line of impingement-plate-type scrubbers can be used for wet cleaning, absorption, or cooling of gases resulting from a wide range of processes. Both single and multiple impingement plate units are available.

Scrubbing is accomplished by the turbulent interaction of gas and liquid effected by the stainless steel impingement baffle plate. The single-stage scrubber handles dust loadings at inlet of up to 100 grains per cu ft. It can remove suspended materials in a gas stream that range from submicron fumes to dust particles in the larger micron sizes with efficiency in excess of 99% on many types of dust. Major parts are the shell; gas inlet; one or more impingement baffle plate stages; mist eliminator; clean gas outlet. Liquid consumption is 1 to 3 gal per 1000 cfm at 20-40 psig.

W W Sly Mfg Co, 4700 Train Ave, Cleveland 1, Ohio

MORE DATA? Circle 75, inside back cover

NEW...from RCA

The best designed AIR GAGE ever offered!

COMPARE THESE OUTSTANDING FEATURES!

- Four ranges of adjustable magnification are provided with 10" linear scale.
- Tube is spring-loaded with positive seal to provide for simple change and removal.
- Captive float cannot drop out when tube is removed.
- Four spare tubes and scales can be stored internally in the column.
- Modular design permits flexibility in grouping units with minimum space.
- Complete range of tooling is available for gage use.

No other air gage on the market can match the ease and compactness with which these RCA units can be grouped into multiple systems . . . expanded at will at minimum cost. Their attractive functional design with this built-in expansion feature is certain to be a welcome innovation to all users of such equipment.

RCA offers these Air Gages as single or multiple units for bench-type operation or as components of automatic systems. A complete range of tooling is also available for all types of measurements normally performed with this equipment.

RCA also manufactures Industrial Computers and Controls, and a complete line of Electronic Gaging Systems, Grinder Controls, Automatic and Bench-type Hardness Testers, Parts Feeding and Assembly Systems and Electronic Comparators. Whatever your automation requirements, RCA offers the most versatile range of equipment available.

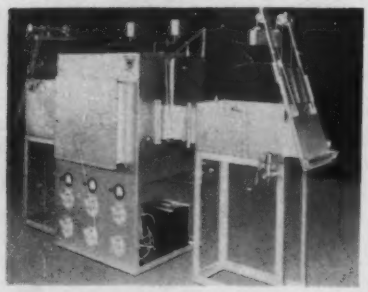
Before you buy Air Gaging, Check RCA. Write to RCA, Industrial Controls, Dept. **XD-139,** 12605 Arnold Avenue, Detroit, Mich., or see your RCA Representative.

RCA

The Most Trusted Name in Electronics

RADIO CORPORATION OF AMERICA

CIRCLE 328 READER SERVICE CARD



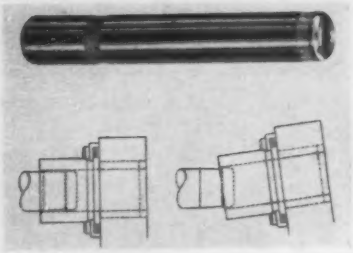
3-Zone Heat Treating Furnace Designed for Hydrogen Atmosphere

Model SNX-10248 straight-line unit consists of an insulated pre-heat zone, a central high temperature zone, and a water-cooled exit zone. Both the entrance and exit ends are equipped with counter-balanced, sliding plate doors and a solenoid-operated flame curtain. Depending upon the maximum operating requirements, the unit may be equipped with an alloy muffle (1900 F) or with a ceramic muffle (2600 F).

The hot zone is separated from the entrance and exit areas by interior blast gates, manually operated from the outside. This zone incorporates silicon carbide heating elements divided into three separate banks, each controlled by its own voltage regulating transformer with fine and coarse tap switches (36 taps), and with a direct reading power input ammeter. Chamber is 10 in. wide x 24 in. long x 8 in. high. Power requirements are 35 kw, 440/60/3.

Pereny Equipment Co, 893 Chambers Rd, Columbus 12, Ohio

MORE DATA? Circle 76, inside back cover



Pilot Guide Post Speeds Dieset Assembly

Precision Pilot guide post has a pilot section just below the top of the post which consists of a narrow band followed by a tapered undercut and which, according to the manufacturer, is accurately ground for maximum ease of assembly and minimum loss of guide.

In assembling a dieset, the new post assures easy alignment even when the punch holder is not placed squarely on the post. As punch holder is placed in position the bushing hesitates on the pilot section and, with a pivot action, comes into alignment with the post. These posts are available for all Danly precision diesets.

Danly Machine Specialties Inc, 2100 S Laramie Ave, Chicago 50, Ill

MORE DATA? Circle 77, inside back cover

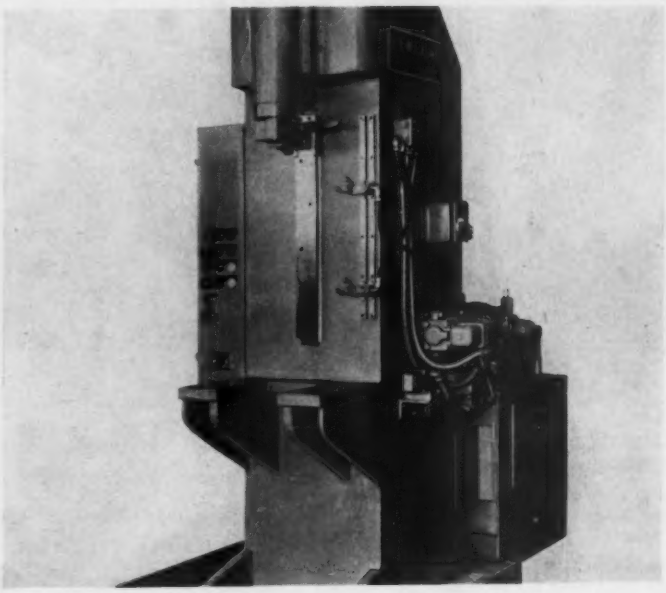
New Line of Toolbits Offered By Morse Twist Drill

Or-Bit series, available in two types of steel, is suited for general purpose work in most materials as well as for cutting high-tensile-strength materials. The Or-Bit IV series is made from an M-4 HSS composition which is said to combine outstanding abrasion resistance with high edge strength to withstand the shock of intermittent cuts. They are available in regular flat and square size, either ground or Form Finished; the latter features the same performance characteristics as the ground bits at much lower prices.

Or-Bit XV toolbits are made from a type of cobalt steel capable of being treated to higher hardness than ever previously achieved in high speed steels. These are especially well suited for machining high-tensile-strength materials, such as heat-treated steels, and for resisting the abrasion encountered in cutting hard cast iron, cast steel, aluminum, brass, and plastics.

Morse Twist Drill & Machine Co, 163 Pleasant St, New Bedford, Mass.

MORE DATA? Circle 78, inside back cover



Standard Press-Type Broaching Machines Operate at Speeds up to 50 Feet per Min

Designed primarily for automated, high production operations, new GPB series press-type broaching machines are offered in six standard models. Operating capacity ranges from 4 to 15 tons with a stroke span of 22 to 36 in.

Three of the models in this line have broaching speeds up to 50 fpm. reportedly twice the speed of conventional press-type broaching machines and all models are equipped with a 4-way guided ram.

Other features are, open-knee platen and pot type chambers for easy installation of automated loading and unloading equipment, 4-way solenoid control of tooling, fixturing, and part positioning, and easy conversion to push or surface broaching.

General Broach and Engineering Co, 14333 Prairie Ave, Detroit 38, Mich

MORE DATA? Circle 79, inside back cover

MAKE THE RIGHT DECISION
from the line that means the most

With men who know their press brakes, Niagara means the most. Mechanical or hydraulic, there's a tremendous choice of sizes and bending capacities in a 15-1000 ton range. From 121 models, you're sure to make the right press brake decision.

Yes, you'll find it pays to talk "press brakes" with Niagara . . . for here you'll be talking with press brake people who not only build them all, but take pride in building them *best of all.*

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15, 30, 60 ton — Mechanical	Bulletin 90
90 thru 1000 ton — Mechanical	Bulletin 89
200 thru 1000 ton — Hydraulic	Bulletin 91
Dies	Bulletin 92

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mechanical and hydraulic

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District Offices and Distributors everywhere.

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

CIRCLE 329 READER SERVICE CARD

New Strippit Quick-Change Holder with Micro-Set Gaging System for use on any 15-A, 10-AA or 10-A Strippit Fabricator, with jig bored Micro-Bars and Dial Indicators, allows gage settings to the nearest .001" in seconds. Guess work eliminated in close tolerance gaging—spring loaded Dial Indicators provide sensitivity and "feel" in settings. No need for special gages or jo-blocks. Use quick-reading built-in scales when close tolerance gage settings are not required.

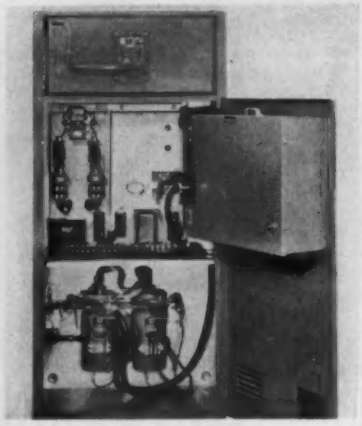
This new system, now available on all new Strippit 15-A Fabricators, also quickly adapts to all existing 15-A, 10-AA and 10-A Fabricators. Let your Strippit Tool & Methods Engineer arrange to demonstrate this new Micro-Set Gaging System to you. Or write for Catalog MS.

WALES **STRIPPIT** INC.

200 Buell Road Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario; In Continental Europe: Raskin, S. A., Lausanne, Switzerland; In the British Isles: Kearney & Trecker—C.V.A. Ltd., Hove, Sussex England.

NEW SHOP EQUIPMENT



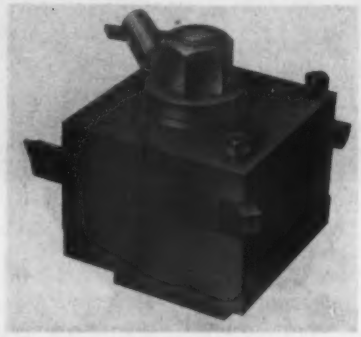
Square D Welder Control Is Completely Transistorized

An extension of the Square D Norpak static welder control system, these controls use transistor timing and switching circuits to replace the conventional thyratron timing tubes and switching relays. Typical applications include automatic conveying systems, machine tool control, and numerical positioning.

Norpak static welder control is available with static cycle counter circuits for absolute accuracy. Highly accurate RC timing circuits are also offered. A regulated, filtered power supply provides a closely controlled voltage for operation of the logic circuitry and also contributes to accurate timing.

Square D Co, 4041 N Richards St, Milwaukee 12, Wis

MORE DATA? Circle, 94, inside back cover



VERSATILE TOOLHOLDER is machined to fit all lathes and designed to accept standard size cutting tools in 3 positions, boring bars, and parting blades. All tool openings are hardened and the rocker base permits accurate positioning of the tool in relation to the centerline of the work, eliminating trial and error shimming of tools—*Koning Machine & Tool Co, Holland, Mich*

MORE DATA? Circle 95, inside back cover

Evaluate Sparkonite® 3 . . .

newest Mallory EDM electrode material

Latest addition to the Mallory line of EDM electrode materials, Sparkonite 3 is an economically priced graphite-base material with high strength and density and superior machining properties. Look at these characteristics:

Density	1.9 gm/cc
Cross breaking strength	6200 psi
Volume wear ratio	
on steel	5.5
on carbide	0.3
Metal removal rate (on steel or carbide)	Superior to brass
Resistance to edge breakdown	Edges last 4 to 5 times longer than brass

Sparkonite 3 is available in slabs up to 12 x 12 x 2½ inches and in rounds up to 6½″ diameter x 12″ long. Mallory welding distributors across the country carry a complete line of Sparkonite and Elkonite® EDM electrode materials in a broad range to suit every job you may have. Write to us for the name of the distributor nearest you, and for informative literature on our complete line of EDM materials. Mallory Metallurgical Company . . . a division of P. R. Mallory & Co. Inc.

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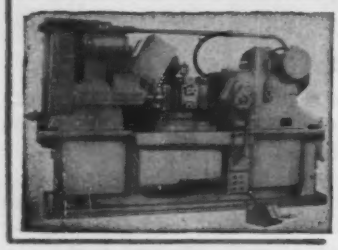
ALL finishing operations...

MEANS GREATER ACCURACY *with* **GOSS DeLEEUW**



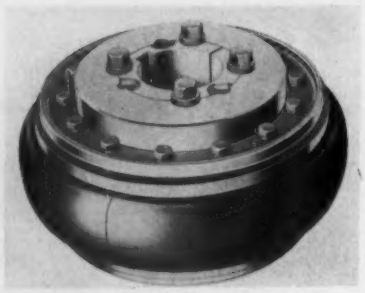
AUTOMATIC CHUCKING MACHINES

One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & DeLeeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & DeLeeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

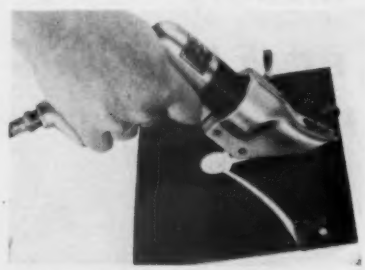


Flexible Cushion Coupling Will Handle 400 hp per 100 rpm

Heavy-duty PX280, largest in the Para-flex line, is designed for applications with high torque requirements. It has more than twice the torque capacity of the next smaller size and features the standard tire-shaped flexing element to accommodate angular and parallel shaft misalignment and to absorb end float, shock, and vibration. It will handle 400 hp per 100 rpm. Capacity at maximum recommended speed of 910 rpm is 3640 hp. It is available from stock with Taper-Lock bushings for shafts up to 7 in. in dia, or may be ordered bored-to-size for shafts as large as 9 in.

Dodge Mfg Corp, Mishawaka, Ind

MORE DATA? Circle 96, inside back cover



Buckeye Adds Air-Powered Sheet Metal Shear to Line

New sheet metal shear will cut a 7/32-in. path through such materials as 18 gauge mild steel, 1/16-in. laminated plastic, aluminum, tin, Formica and several types of glass fiber. Cuts can be started from either the edge of a sheet or a ¼-in. access hole and then continued in any desired pattern of lines or circles up to 2 in. radius.

Shear housing rotates through 360 degrees for convenience in cutting hard to reach areas. The shear is available in pistol grip or straight-type models, both weighing about 2 lbs and both priced at $125.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 97, inside back cover

faster finishing...by far!

The new SWECO Vibro-Energy* Finishing Mill does in 35 to 165 minutes what ordinary vibratory equipment *takes 5 hours to do.* Results of 8 impartial comparison tests (weight loss in grams and RMS improvement, on cast iron, hard steel, stainless and aluminum) prove SWECO produces the same finish *in 45% to 88% less time.* Charts of all 8 tests are included in a new, illustrated technical treatise that will be mailed on your request. It describes in detail the superior performance of high-frequency, three-dimensional vibration in finishing metal, ceramic and plastic parts. For a copy, write SOUTHWESTERN ENGINEERING COMPANY, 4800 Santa Fe, Los Angeles 58, Dept. 74381

SWECO
*TM SEC

Vibro-Energy Separators, Grinding Mills, Finishing Mills

IF you manufacture:

air conditioning appliances
electronics
communications
electrical apparatus
fans
blowers
machine tools
materials handling
panelboards and switch boards
prime movers
pumps
compressors
general machinery

these Westinghouse products are tailored for you

On these pages are shown some of the many components developed and manufactured by Westinghouse specifically for OEMs. Here is one single source for technical assistance, manufacturing and stocking of all of your electrical needs. Use this *total* service to solve your design and manufacturing problems now. Call your local Westinghouse Sales Engineer or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96163-R

Westinghouse

NEW

AB-I breakers

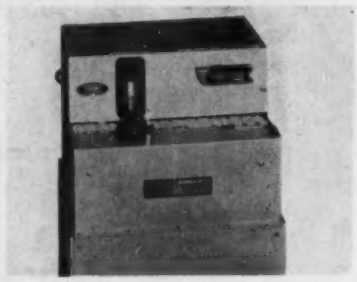
Often cost less than safety switches yet are better, smaller, lighter. AB-I Breakers for motor circuit protection are installed faster, approximately half the size, ⅓ the weight. Machine operator can "re-set" and contacts can be visible. Write for Bulletin B-7350 and be convinced—Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96164

Westinghouse

CIRCLE 334 READER SERVICE CARD

NEW SHOP EQUIPMENT



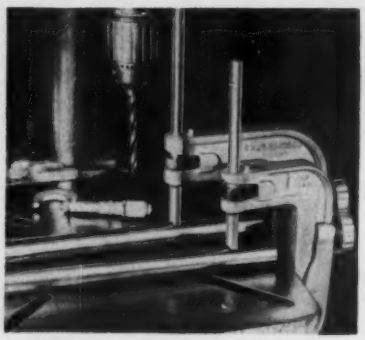
Compact Automatic Checkweigher Has Capacity up to 12 oz

Model 1205-S Selectrol is 20 in. deep, 22 in. long, and has an adjustable height of 35 to 40 in. Unit will automatically weigh, classify, and separate packages by correct weight, overweight, and underweight at speeds up to 200 per min depending on accuracy requirements and product handling characteristics. Standard models will weigh packages in a range up to 12 oz.

Precision scale with a 1:1 ratio even balance lever provides high sensitivity with minimum effect from floor vibrations. Model is equipped with plug-in transistor amplifiers and power supply employing printed electrical circuits. Fully enclosed construction with NEMA 12 rated electrical system insures protection against dust and moisture.

Exact Weight Scale Co, 541 E Town St, Columbus 15, Ohio

MORE DATA? Circle 98, inside back cover



DEEP THROAT CLAMP is quick opening and closing because of a threadless spindle that slides to and locks on the piece to be pinned. A finger-tip-control thumb screw applies clamping pressure without frame distortion and without causing the spindle to turn and mar the work. The aluminum clamp is available with anvil or vee spindles in carbon or stainless steel. Beryllium copper vee spindles can be furnished for splatter free welding—*United Associates, 1605 N Hercules Ave, Clearwater, Fla.*

MORE DATA? Circle 99, inside back cover

NEW

Oil-Tite pushbuttons

Simple, rugged, contamination-proof. Flush oil-tite pushbuttons with minimum projection keep oil, coolant, cutting oil or water from contacts. Wide variety of head types and interchangeable color caps make this one of the most flexible lines of pushbuttons available today. Write for Bulletin B-7321, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96166

Westinghouse

NEW

Black Line Control transformers

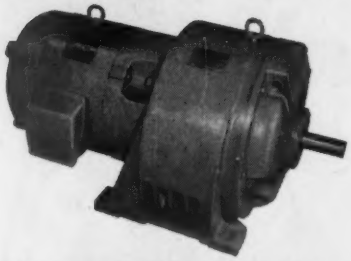
Especially designed for machine tool control. Compact design plus Westinghouse's exclusive "BONDAR" Class "A" insulation combines quality and minimum space in Black Line Transformers. Offered in a wide range of voltage ratings—.025 kva through 5 kva with a 55° C. rise. For details, write for Bulletin B-7879 to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96170

Westinghouse

CIRCLE 335 READER SERVICE CARD

NEW



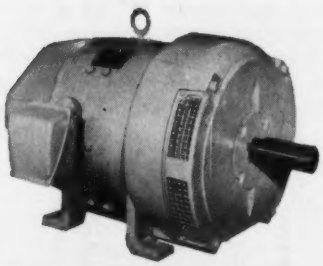
Magnaflow electromagnetic drives

Economy, less space, 17:1 speed range or more. Includes everything needed for stepless wide-range speed control from a-c power. Has a-c motor drive, electromagnetic coupling, regulating exciter, operator control station plus variety of modifications to suit special operating conditions (¼ to 700 hp). Write for B-7875, Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96167

Westinghouse

NEW



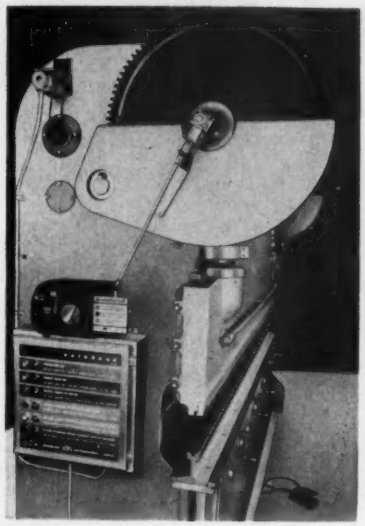
TEFC d-c motor

For fastest d-c motor response! New totally-enclosed, fan-cooled Life-Line H d-c motor with 75% less armature inertia, 500% commutating ability for acceleration results in faster stops, quicker stops, faster reversing. 30 hp rating accelerates from 0 to 1750 rpm—fully loaded—in 1.1 sec.; similar response in ratings 1 to 75 hp and higher. Write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96168

Westinghouse

NEW SHOP EQUIPMENT

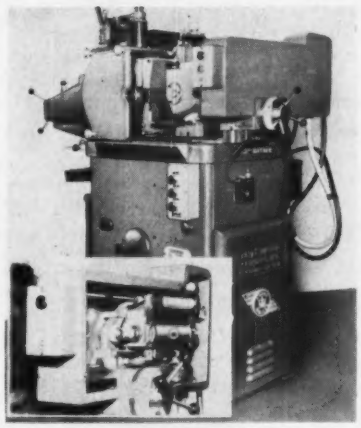


Control Unit Attaches To Press Brake For Automatic Production

An automatic production control that can be attached to any size or model press brake, the Autobend BC-100 is said to eliminate whipping and give pushbutton control for uniform bends. The unit automatically cycles the brake and, with stepless control to 100% speed, provides the correct bending speed for the metal being worked.

General Automation Corp, 121 Centre Ave, Secaucus, NJ

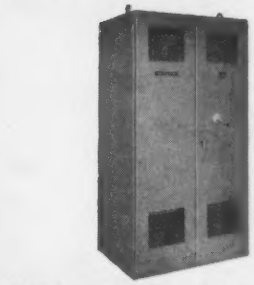
MORE DATA? Circle 100, inside back cover



CENTERLESS GRINDER Model CG-12-A will grind multi-diameter parts and balls out of stainless or carbon steel, glass and plastic. The automatic-cycling grinder features a heat-treated alloy spindle with ball bearings lubricated for life, manually or hydraulically operated wheel dressers, and regulating wheel spindle mounted between ball bearings to prevent deflection—*Royal Master Grinders, Riverdale, NJ*

MORE DATA? Circle 101, inside back cover

NEW



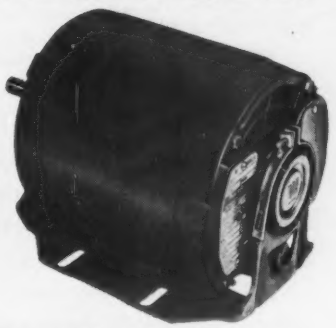
AVR adjustable speed drives

Static design, less floor space, easy installation, flexible. System converts a-c to d-c to operate an adjustable speed d-c motor. Includes a power unit, main d-c drive motor and operator's control station. Available from 1 to 200 hp or larger. Write for Bulletin 5601 to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96172

Westinghouse

MOTORS



fractional hp

Operates 25,000 hours without re-oiling on light duty applications, uses specially designed sleeve bearing lubrication system. Over 550 motor styles rated ⅛ to 1 hp in variety of combinations of mechanical features are stocked by Westinghouse at all times to meet your instant needs. Write for Bulletins 2820 and 2850 to Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

J-96173

Westinghouse

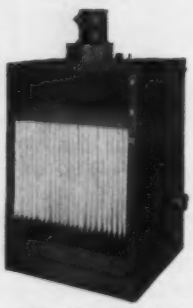
"THE GRIEVANCE COMMITTEE IS HERE ...ABOUT THAT DUST AGAIN!"

"This was the third time in a month that the grievance committee had complained about the dust in the shop. And this time they wanted to know what I intended to do about it.

"Frankly, I was on the spot. Oh, not that I blamed the workers. I knew the shop was dirty. How could it be anything else with grinding machines running 16 hours a day? And I was as unhappy about the situation as the employees were. Poor employee morale was serious enough—and absenteeism, machine wear, misalignment and down time caused by dust was costing plenty.

"Then I remembered a salesman with a dust collecting machine system had called on me a few months back. I dug his card out of the file and found he was from the Torit Company. I got him in pronto—and I bought one of his Model 90 Cabinet machines for less than $1,000. It services four surface grinders and it really performs. A month later I had Torit Dust Collectors installed for the rest of the machines.

"Torit Dust Collectors have practically eliminated the dust in our shop. And you can imagine the effect this has had on employee morale. People are happier and healthier. Absenteeism is no longer a problem and our production rate is higher than ever."



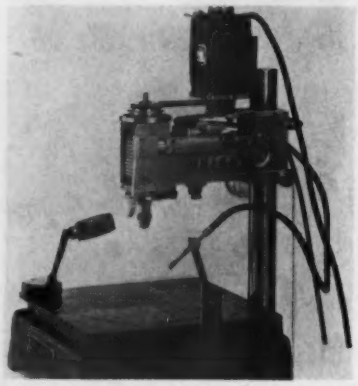
Cabinet Model 90

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 431

NEW SHOP EQUIPMENT



Mico Precision Drillpress Has Pneumatic Spindle Control

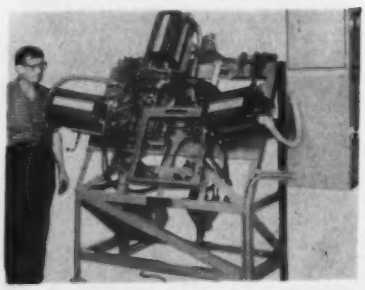
The new No. 905 precision drillpress with pneumatically-controlled spindle was developed for production drilling of very small holes with other-than-skilled personnel. The design reduces deflections when drilling, thereby increasing accuracy of holes and reducing small drill breakage.

The spindle's fine adjustment controls approach of drill to work surface and gives a steady, even feed to pre-set depth. When air control is released it gives a quick spindle return. Provision is made for mounting an air mist accessory on the drillpress when air mist or air stream is needed to keep drill cool or clear away chips.

An Albrecht keyless drill chuck of ⅛-in. capacity is standard equipment, and a choice of 7,500 or 10,000-rpm, 1/10-hp motors is available.

Mico Instrument Co, 80 Trowbridge St, Cambridge 38, Mass

MORE DATA? Circle 102, inside back cover



INCLINED FRAME WELDER mounts six welding guns and necessary inner die units for welding oven front brackets to oven fronts. Each gun and die unit is mounted on a subplate in guided slide and is fully adjustable for different sizes of assemblies—*Federal Machine & Welder Co, Warren, Ohio*

MORE DATA? Circle 103, inside back cover

New—
CARMET'S 700 Series Cutting Grades and the fine art of making chips

Some people baby their carbide tools. They hold back a little on roughing cuts, because they've heard carbide is pretty brittle . . . and some of it is. Or they ease off on finishing cuts, because their tool may be too soft for long, fast passes . . . because it may wear or crater. And, some of it will.

But this is "paring-knife" machining, and it really isn't necessary. Not any more . . . not since Carmet introduced the 700 Series Steelcutting Grades. No paring knife made these chips . . . these were hogged out on a production basis by one of Carmet's new carbides . . . Grade CA-720.

The job: rough facing railroad axle forgings in an automatic tracer lathe—210 sfm—.076" feed—1¼" width of cut. The result: over 1,000 cubic inches of steel removed in 5½ minutes, floor to floor, with plenty of red hot chips like these. And, 35 axles per tool against 25 pieces for the best competitive carbide tool . . . a tool carrying a higher price tag.

Carmet's 700 Series have the edge wear and crater resistance, *and* the ability to endure shock and heat, to breeze through jobs like this. They're doing just that all over the country . . . right now! Next time you're setting up a mean, tool-buster of a cut, let the 700 Series make chips and money for you, just once. Your Carmet Distributor has the local stock and all the information. Call him, or write:
Carmet Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan: Dept. AM-7

CARMET® AL

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

3932

Which pre-paint phosphate coating is best for you?

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

Undercoat of Oakite CRYSCOAT adds to the looks and life of finishes

From toys to tractors, painted metal products look better and last longer with Oakite CrysCoat under the paint.

CrysCoating—the conversion of a steel surface to a phosphate surface—creates a perfect base for paint adhesion. Paint goes on in a smooth, serviceable coat. Once on, it stays on.

At the same time, a CrysCoated surface prevents the formation of rust . . . even prevents rust spreading from a deep scratch. Both metal and paint are safeguarded. The product looks better, lasts longer.

Oakite has a CrysCoat process to fit every requirement—for iron phosphate or zinc phosphate coatings, for spray washer or for tanks. Is your particular problem one of economy? Durability? Production bottle-neck? For a helpful answer, ask your local Oakite man. Or write for details to Oakite Products, Inc., 26H Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

NEW SHOP EQUIPMENT

Malfunction Control Shuts Down Machines, Indicates Trouble Spot

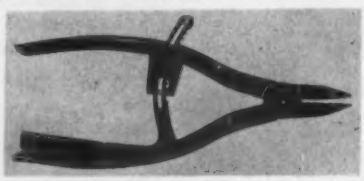
Machinery is instantly shut down and source of trouble indicated by the Prescon control system which detects missing parts, mislocation of parts, malfunctions, stock buckling and end of stock.

The small detector contains one to five completely interchangeable sensor modules and can be mounted directly on a machine or at any other desired location. Power required is 120 vac and the sensors operate on 12 v.

The control, which can send a visual and auditory signal to remote locations, is fully transistorized and has only one moving part that is actuated when a malfunction occurs.

W J Saeman Co, Inc, 256 First Ave SW, Carmel, Ind

MORE DATA? Circle 104, inside back cover



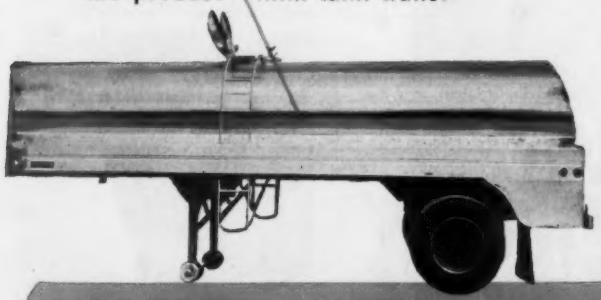
Retaining Ring Pliers Offered For Heavy-Duty Jobs

The No. 5R is designed to compress internal-type rings for assembly or disassembly in a bore or housing; the 6R expands external rings for installation or removal over a shaft. Double-ratchet construction reduces the effort necessary to spread or compress the rings and locks the pliers at any given point of expansion or contraction. Both pliers are equipped with replaceable tips bent to a 15° angle. Price is $7.75.

Waldes Kohinoor Inc, Truarc Retaining Rings Div, 47-16 Austel Pl, Long Island City, NY

MORE DATA? Circle 105, inside back cover

the product / milk tank trailer



INCREASED OUTPUT PAYS FOR RETOOLING PROGRAM IN 58 DAYS...

NETS $58,000 DIVIDEND/YEAR!

Inefficient and outdated power tools were costing this plant money. A power tool study revealed that in the assembly of tank trucks alone, 29 out of 66 tools were operating at only 40 to 50% efficiency.

New, more efficient Ingersoll-Rand Air Tools with full power and speed replaced the old tools. Fifteen additional I-R tools were installed to cut fabrication time on other operations. Leaks, faulty oilers and air filters were corrected. The net result: increased production that amounted to a $58,000 Dividend on Payroll Dollars the first year.*

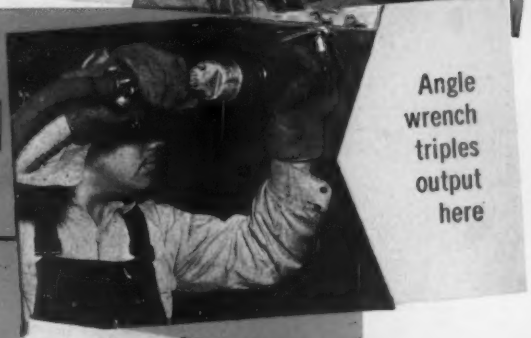
With production increases making up the full cost of the tool replacement program in just 58.6 working days, an immediate Planned Annual Retooling program was started to maintain peak tool efficiency and maximum output.

A power tool study in your plant can more than likely show how you can reduce your costs through increased output per man with more efficient tools.

*For details, call your I-R AIRengineer or write Ingersoll-Rand, 11 Broadway, New York 4, N.Y.

216A-8

15,000 rpm grinder speeds weld removal



Angle wrench triples output here

Bolt assembly time cut by 67%

Impactool cuts die changing time in half

5 man-hours a tank saved running self-tapping screws

Ingersoll-Rand

Planned Annual Retooling increases output per man

WEDGMOUNT LEVELING MACHINERY MOUNTS

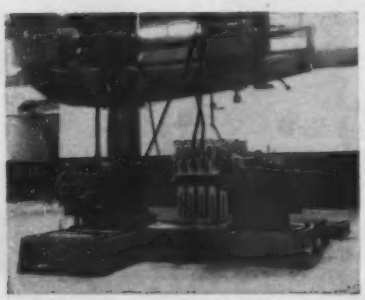
You can now effectively dampen and isolate the vibration, shock and noise of any machine with Wedgmount machinery mounts.

Wedgmounts are manufactured in a wide range of sizes and capacities so that it is possible to control the vibration of any type of machine tool — from punch press to grinder.

Wedgmounts are installed without bolts or cement and installation takes but a matter of minutes. Because of their opposing wedge construction, Wedgmounts are easily leveled by means of an adjusting bolt — no need for shimming.

Other models, retaining the leveling feature, are available to use where bolting to the floor is mandatory, or where it is desired to make the mount an integral part of the machine.

Write for full information about Wedgmount leveling machinery mounts.

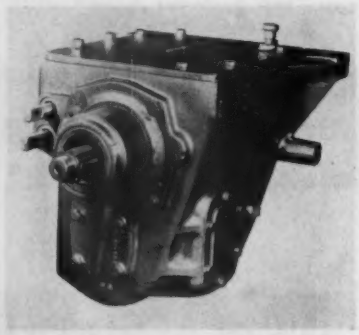


* The photograph above is from an actual Wedgmount installation. It is one of eight 4" x 8" Type S Wedgmounts supporting a Cincinnati-Bickford 6 foot radial drill, shown at left.

Air-Loc® DIVISION

Clark, Cutler, McDermott Co.

100 WEST CENTRAL ST. • FRANKLIN, MASS.

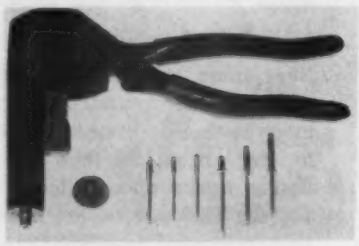


Four-Speed Transmission Has Helical Gears for Easy Shifts

Constant mesh helical gears throughout the spicer model 7041 auxiliary 4-speed transmission are said to give quieter operation and easier shifting in all gear positions. Designed for use with standard four or five-speed transmissions in the 400 to 600-ft-lb capacity range, the 340-lb transmission is said to have excellent ratio splits in the top three gears. Shifting is accomplished at the same rpm in these splitter gear positions so that maximum engine horsepower can be used during shifts.

Dana Corp, Toledo 1, Ohio

MORE DATA? Circle 106, inside back cover



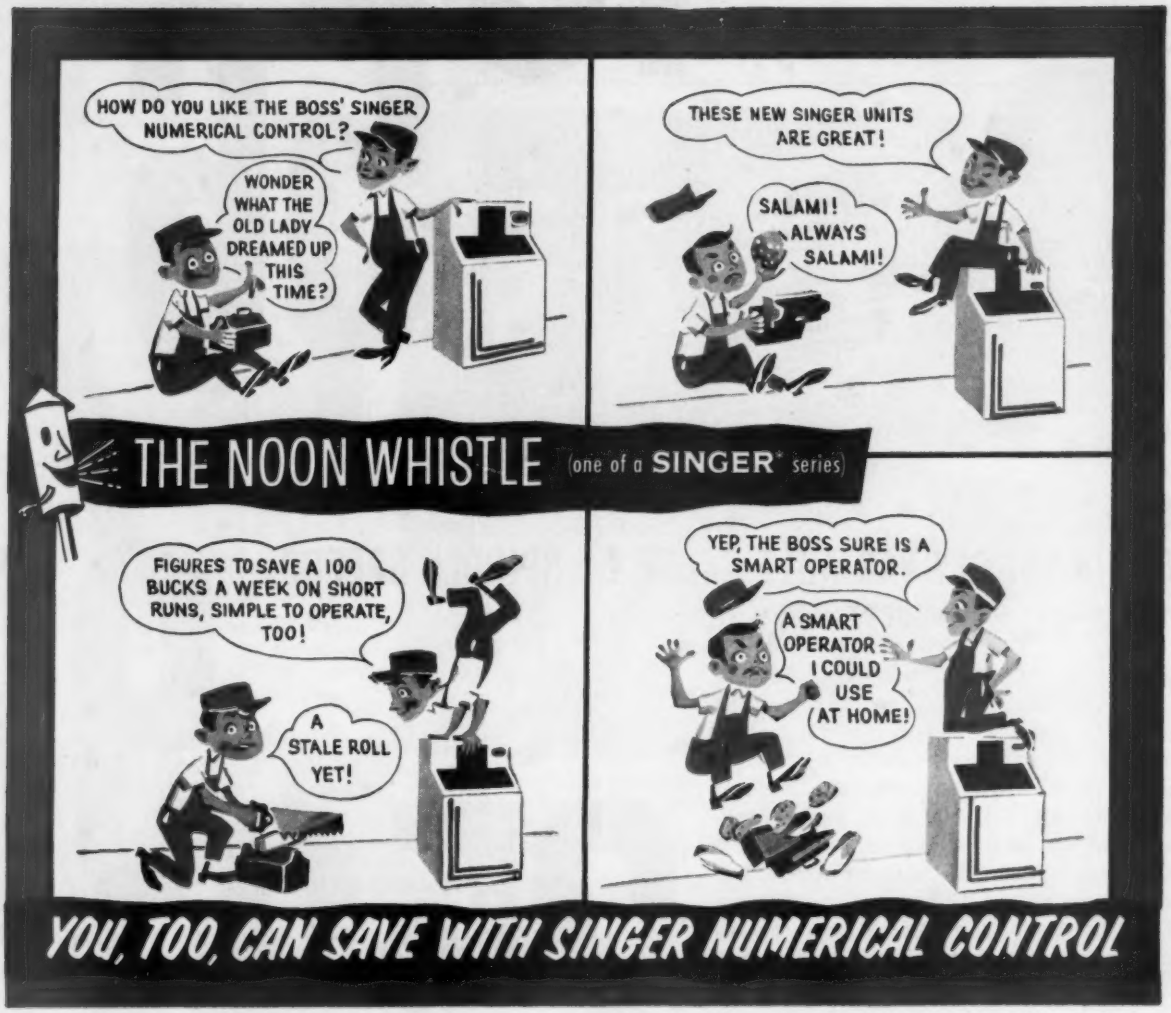
Geared Hand Rivet Gun Gives 1½-ton Gripping Power

The Split Champ AP-7, with gear ratio greater than 10:1, can handle all sizes of jobs where two pieces of material are to be fastened. Long nose reaches all work areas and takes blind rivets from 1/8 to 3/16 in. dia up to ¾ in. long. All riveting is done from one side, in space no larger than the rivet. ID need be no greater than the rivet's extension through material yet maximum pressure is exerted on the two members before setting into a permanent, vibration-proof joint.

This type of fastening is especially suited to joining two pieces of metal, either steel or aluminum. It is also recommended for metal-to-plastic or metal-to-wood joints.

Mid-American Mfg Co, 1919 Champa St, Denver 2, Colo •

MORE DATA? Circle 107, inside back cover


HOW DO YOU LIKE THE BOSS' SINGER NUMERICAL CONTROL?
WONDER WHAT THE OLD LADY DREAMED UP THIS TIME?
THESE NEW SINGER UNITS ARE GREAT!
SALAMI! ALWAYS SALAMI!
THE NOON WHISTLE (one of a SINGER* series)
FIGURES TO SAVE A 100 BUCKS A WEEK ON SHORT RUNS, SIMPLE TO OPERATE, TOO!
A STALE ROLL YET!
YEP, THE BOSS SURE IS A SMART OPERATOR.
A SMART OPERATOR I COULD USE AT HOME!
YOU, TOO, CAN SAVE WITH SINGER NUMERICAL CONTROL

These actual case histories show how 41½ hours of machine shop production by the usual method were reduced to 5½ hours with SINGER Numerical Control:

JOB	USUAL METHOD	SINGER NUMERICAL CONTROL
(1) Drill Jig for Terminal Board, Jig Bore all Holes	8 Hours	2 Hours
(2) Jig Bore 38 Holes in each of Three Chassis	3 Hours/10 Min. x 3 Pieces = Total 9½ Hours	First Piece — 25 Min.; Second and Third Pieces — 16 Min.; Total 41 Min.
(3) Nine Motor Housings		
a. Layout 6 holes and drill on faces of housings	1 Hour/10 Min. x 9 Pieces = Total 10½ Hours	First Piece — 23 Min.; Next 8 (total) — 48 Min.; Total 71 Min.
b. Layout 7 holes and drill on outside diameters of housings	1 Hour/30 Min. x 9 Pieces = Total 13½ Hours	First Piece — 26 Min.; Next 8 (total) — 72 Min.; Total 98 Min.
Grand Total:	41½ Hours	5½ Hours

MOST IMPORTANT, you'll find that SINGER Numerical Control will pay for itself in a very short period of time. For full details, write to the address below:

Diehl

DIEHL MANUFACTURING COMPANY
SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY
Pinderne Plant, Somerville, New Jersey
Telephone: Randolph 5-2200

NOW...
CONTINUOUSLY VARIABLE RANGE OF SPINDLE SPEEDS
WITH CONSTANT HORSEPOWER THROUGHOUT

Now, by simply pressing a button until the desired speed is indicated on the direct-reading tachometer, you can select any spindle speed from 43 to 3500 RPM.

The new Micro-Turn features exclusive Nebel coaxial headstock spindle design plus mechanical beltless type variator drive unit (5 HP), which delivers constant horsepower throughout the entire range and maintains drive output speed within two-tenths of one percent. This assures maximum torque at low speeds for heavy cutting and ultra fine finish at highest speeds, with supreme balance and minimum vibration. Built-in positive torque responsive mechanism prevents slippage under starting or shock loads.

Other features include:

- exclusive feed converter unit, located in apron, providing simple conversion from standard to optional feed ranges without affecting standard thread ranges;
- double-wall, one-piece totally enclosed apron;
- fail-safe pressure lubrication to headstock, gear box and end gearing;
- pressure lubrication to carriage and cross slide ways provided by pump located in apron; one-shot plunger to lubricate cross slide ways when carriage is stationary;
- choice of manual or automatic coolant operation.

For the complete, illustrated story on the revolutionary MICRO-TURN, write today for your copy of Bulletin No. 222. Nebel Machine Tool Corporation, Lathe Division, 3407 Central Parkway, Cincinnati 25, Ohio.

NEBEL
MICRO-TURN
HIGH SPEED PRECISION LATHE

CIRCLE 344 READER SERVICE CARD

Eaton Opens New Research Center, Marks Fiftieth Anniversary

A $1.3 million research center designed for development of new products, ideas, and processes has been opened by Eaton Manufacturing Co of Cleveland. The 30,000 sq-ft facility located on a nine-acre site in Southfield, Mich, just north of Detroit, houses an additional $1 million worth of mechanical, metallurgical, chemical, and electrical equipment for use in the company's expanded R & D program.

In addition to development of new products, the Center will also work on improving and refining existing products in the automobile, truck, industrial, and marine fields. This work will be done for the Eaton central organization and for the 26 manufacturing divisions and subsidiaries with 35 plants in six states and four foreign countries. The Center will be staffed initially by 76 people, including 30 engineers.

Facilities include two major labs, mechanical and metallurgical, a design department, model shop, fabrication room, brake testing facility, instrumentation room, stress study room, machine shop, photographic lab, and a road test garage. A separate laboratory is equipped for development of new metallurgical processes, unique casting methods, new methods of applying facings or coatings, and the solution of unusual welding problems. Experiments in the creation of exotic alloys are handled by a high temperature vacuum furnace.

New methods of applying facings or coatings are being developed at Eaton's Research Center. Equipment is available in the metallurgical laboratory for metal spray coating, welding, casting, powder metal work, stress rupture testing, heat treating, and surface coating experiments

$54.5 Million Orders to Lockheed

Three military contracts have been awarded to Lockheed Aircraft, Burbank, Calif. An Air Force order covers $46.8 million worth of spare parts, ground equipment, and data on F104G aircraft mobile training units. A $6 million contract calls for fabricating and testing the F104Q special test vehicle, and a $1.7 million order has been received for inspection, repair, modification, and conversion of the F104A to the F104A drone.

Moore Sets Up Export Division

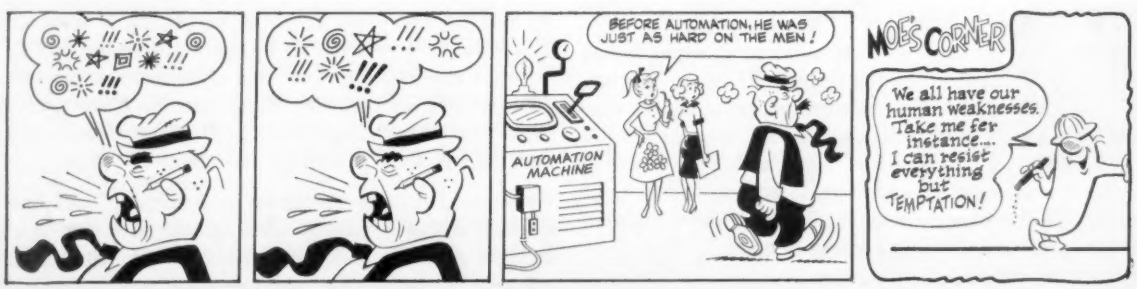
Moore Special Tool Co, Bridgeport, Conn, has established an Export Division in the Empire State Building, New York City, to handle continuing expansion of its overseas sales for jig borers, jig grinders, and measuring machines. Joseph F Rizzo has been named export manager.

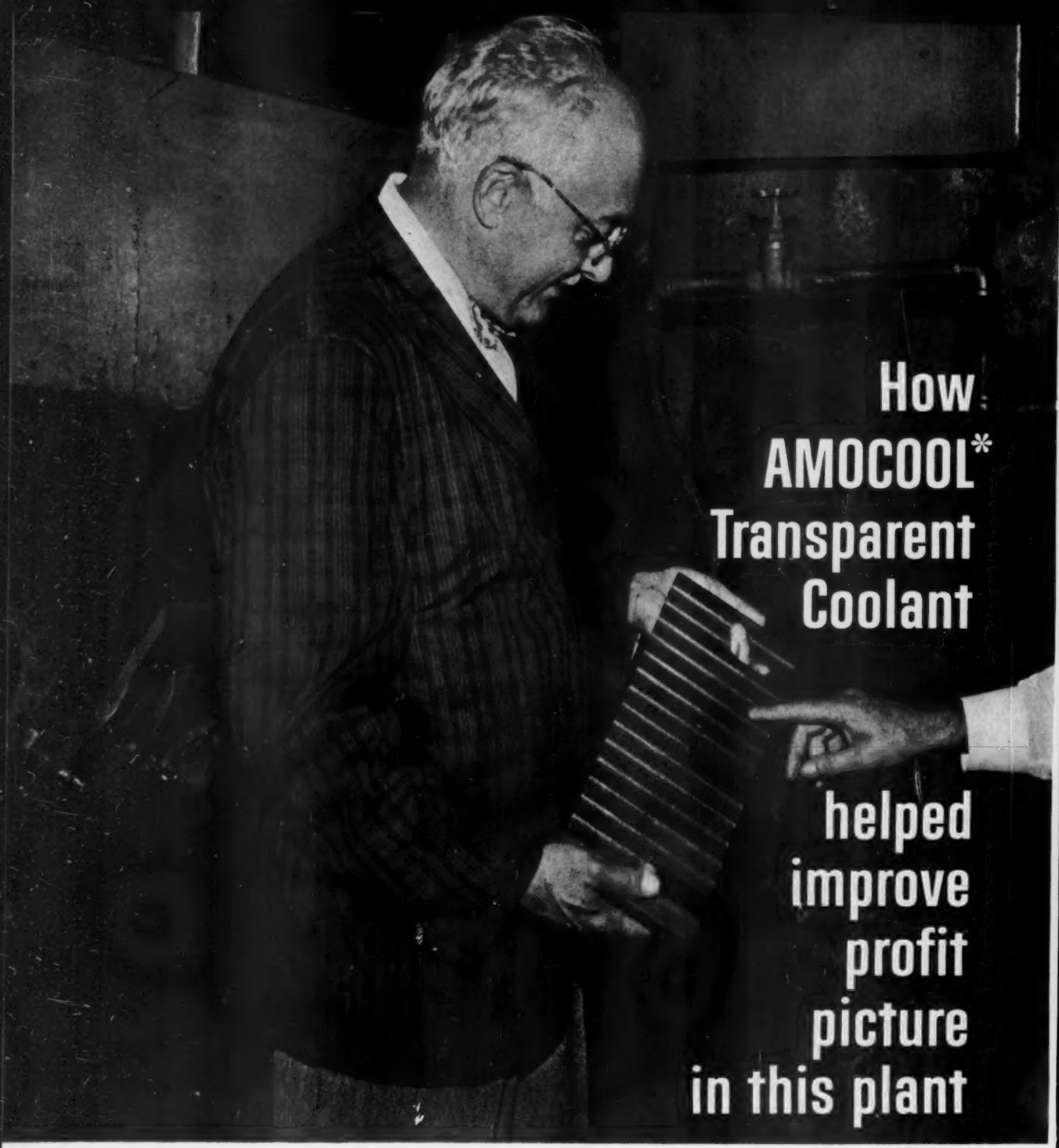
Under the supervision of Mr Rizzo, a Moore No. 3 jig grinder, equipped with metric leadscrews and dials, will be exhibited this year at the Indian Industries Fair, New Delhi. Moore equipment will also be shown at the Milan Trade Fair in April, 1962, by the company's Italian dealers. The Export Division will make periodic visits to the Moore international dealer network to train service personnel and discuss customer requirements for toolroom equipment and procedures.

Ferry Cap Buys Baldwin

Ferry Cap & Set Screw Co, Cleveland maker of cold formed fasteners, has acquired the Baldwin Manufacturing Co, Toledo specialist in the design and production of precision sheet metal parts and assemblies for

McGIRK'S WORKS


BEFORE AUTOMATION, HE WAS JUST AS HARD ON THE MEN!
AUTOMATION MACHINE
MOE'S CORNER
We all have our human weaknesses. Take me fer instance... I can resist everything but TEMPTATION!



How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

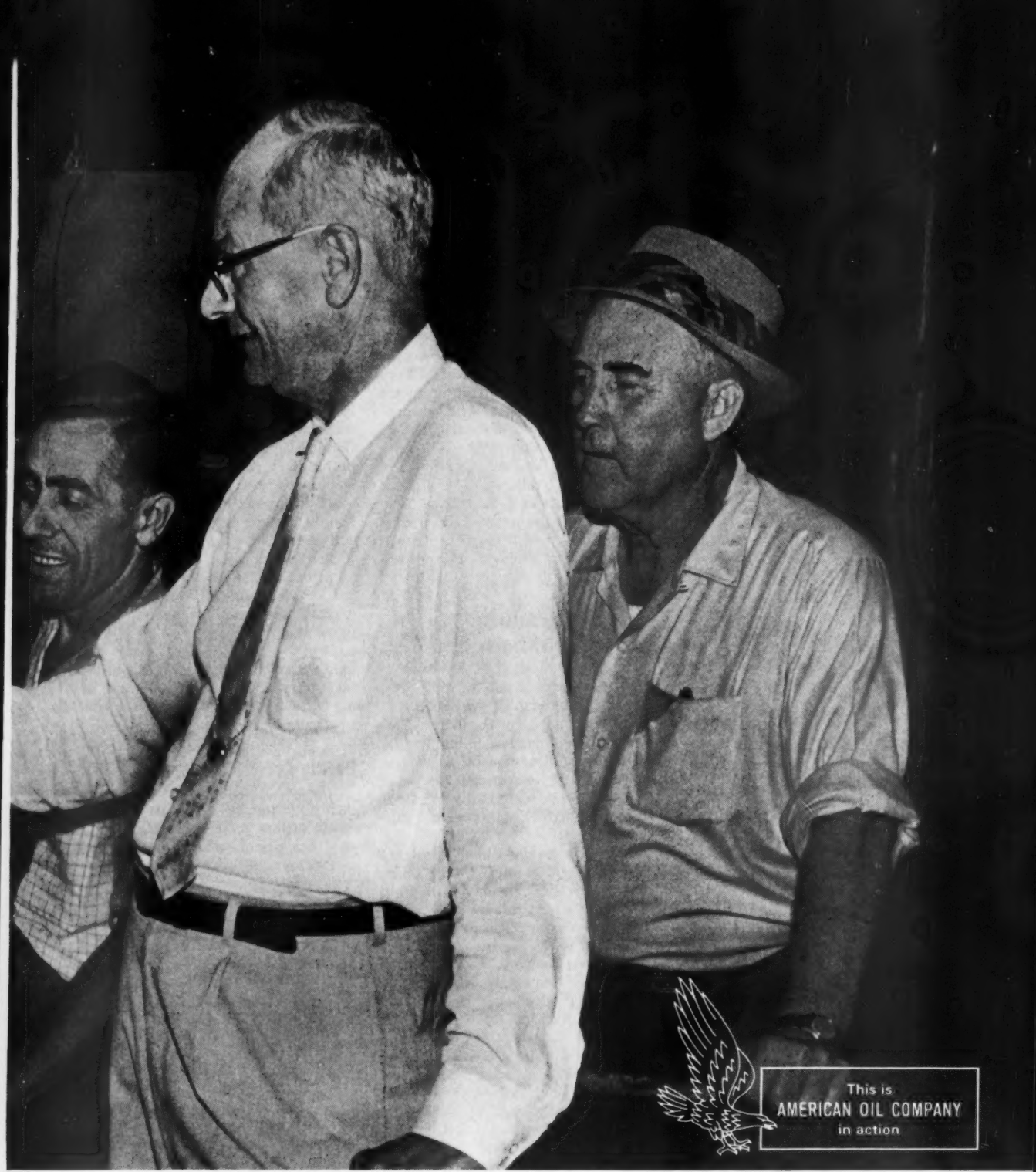
BY PAUL E. "PAPPY" STRATTON

About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been working for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

* * *

By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.



Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

* * *

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

Quick facts about
AMOCOOL
Transparent Coolant

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless

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Fractional, Wire and Letter size drill sets packed in convenient folding index cases.

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Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.

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ACE DRILL
Adrian, Michigan

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

the electric, electronic, and aircraft industries. Baldwin becomes a Ferry division and will continue its Toledo operations.

Chrysler Gets Big Contract

Orders totaling $34.8 million for production of 8503 additional military trucks, ambulances, and weapons carriers have been received by Chrysler Corp from the Detroit Ordnance District. All vehicles will be produced at the Dodge truck plant in Warren, Mich. Contracts will assure retention of the same number of employees for this work for at least another year and a half. More than $7 million of the amount authorized for production of these vehicles will be spent with Michigan subcontractors and suppliers.

Firth Sterling Sells Method X Division to Elox

Sale of the Method X Division of Firth Sterling, Pittsburgh, to Elox Corp of Michigan, Troy, Mich, has been announced by the firms. Elox has acquired certain patent rights, licenses, and trademarks, as well as all physical assets of the Method X Division with right to acquire all other Method X rights at a future date.

Both companies have designed Electrical Discharge Machining (EDM) units for the past ten years. Elox has concentrated on the manufacture and sale of equipment in the US. Method X has concentrated on the development of foreign markets and has directed its activities to developing electrical circuits and licensing machine builders such as Ex-Cell-O Corp in the US and several European firms including Wickman Ltd of England, Fr Krupp and Deutsche Edelstahlwerke of Germany, and Charmilles of Switzerland. Through its foreign licensee arrangements, Method X has been able to acquire valuable supplemental knowledge of spark machining techniques and EDM methods developed in Europe.

Under certain of the patents now owned or acquired in the currently announced transaction, Elox has granted non-exclusive licenses to Cincinnati Milling Machine Co of Cincinnati; Ingersoll Milling Machine Co of Rockford, Ill; and Ex-Cell-O Corp of Detroit.

The research and development activities of both organizations will now be combined and the results coordinated on a world-wide basis for the benefit of users and builders of electrical discharge machines.

Ling-Temco-Vought Inc...

. . . is the name of the combined firm of Ling-Temco Electronics Inc and Chance Vought Corp. Stockholders have formally approved the merger, effective date of which will be Aug. 31.

New firm will probably align itself into various groups or divisions somewhat on the order followed by General Dynamics recently. If these preliminary plans are followed, LTV would be the corporate company with groups or divisions formed to handle seven major categories of activities. These are aerospace systems, electronics, communications and test systems, commercial and industrial products, sound systems, aerosystems, and information handling systems.

As of Dec 31, 1960, combined firms had assets of $194 million, an order backlog of $300 million, and sales of about $362 million. It presently employs about 20,000 people.

Pacific Car & Foundry Co...

. . . Renton, Wash, has been awarded Army Ordnance contracts totaling $15.9 million to produce M-107 and M-110 artillery vehicles. Additional orders amounting to $1.5 million will cover repair parts, tools, and services. Production will begin this month at the Renton plant and continue to July 1963. •

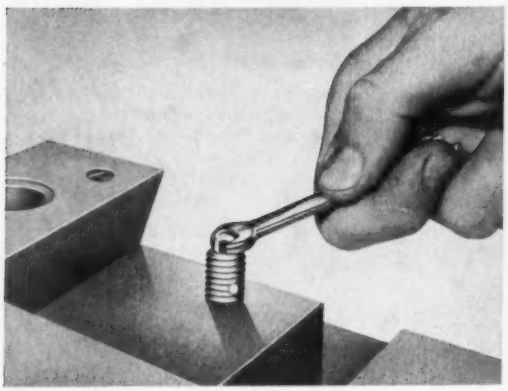
AM/MM

"There was an increase in your pay envelope, Fenstrop. Didn't your wife tell you?"

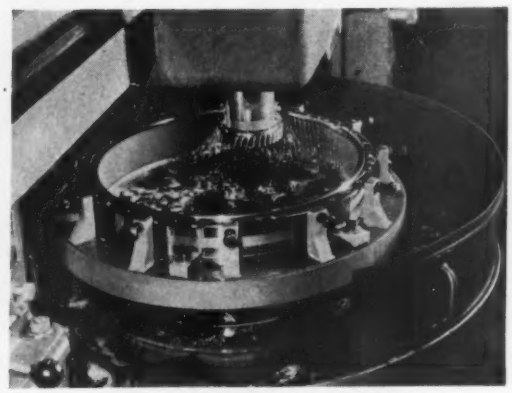
Practical Tooling Tips

No. 4 of a series

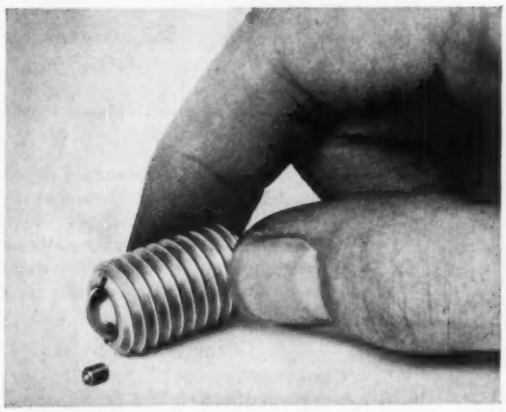
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.



SMALL, PRECISION, SPRING-LOADED BALLS provide controlled end pressures, won't bind from side thrusts. Sizes from 4-48 x 3/16" to 5/8-11 x 1". Various end pressures. Also available in all-stainless steel with Nylok.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

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Engineering Corporation

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CUT SMOOTH!
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OSCILLATOR
THE ANSWER TO YOUR "TOUGH STUFF TO CUT" PROBLEMS
CUTS LARGER SOLIDS
Available on leasing or extended payment plan.
IT OSCILLATES WHILE IT CUTS
LEAVES "MACHINE TOOL" FINISH
Speed-Cut
Abrasive Cutting Machines
MANUAL OR POWER-OPERATED MODELS FOR WET, DRY OR ANY-ANGLE CUTTING!
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ABRASIVE MACHINE DIV
BEAVER PIPE TOOLS, INC.
DANA AVE.
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NAMES IN THE NEWS

Union Twist Drill Co, Athol, Mass, has appointed **Elmer M Burt** assistant sales manager of **Reed Rolled Thread Die Co,** Holden, Mass, subsidiary. Mr Burt was formerly northeast district manager of Twist Drill

Hanson-Whitney Co, Hartford, Conn, maker of taps, gages, and cutting tools, has appointed **Augustus Vogel** vice president and director of sales

Ford Motor Co of Canada Ltd has appointed **William P Park** general manufacturing manager. He moves up from the post of general manager, Windsor manufacturing operations. That post will be filled by **George O Keutgen,** formerly assistant general manager.

Carborundum Co, Niagara Falls, NY, has named **Robert W Lear** vice president in charge of marketing. Prior to joining the company Mr Lear was director of marketing services, American Radiator & Standard Sanitary Corp.

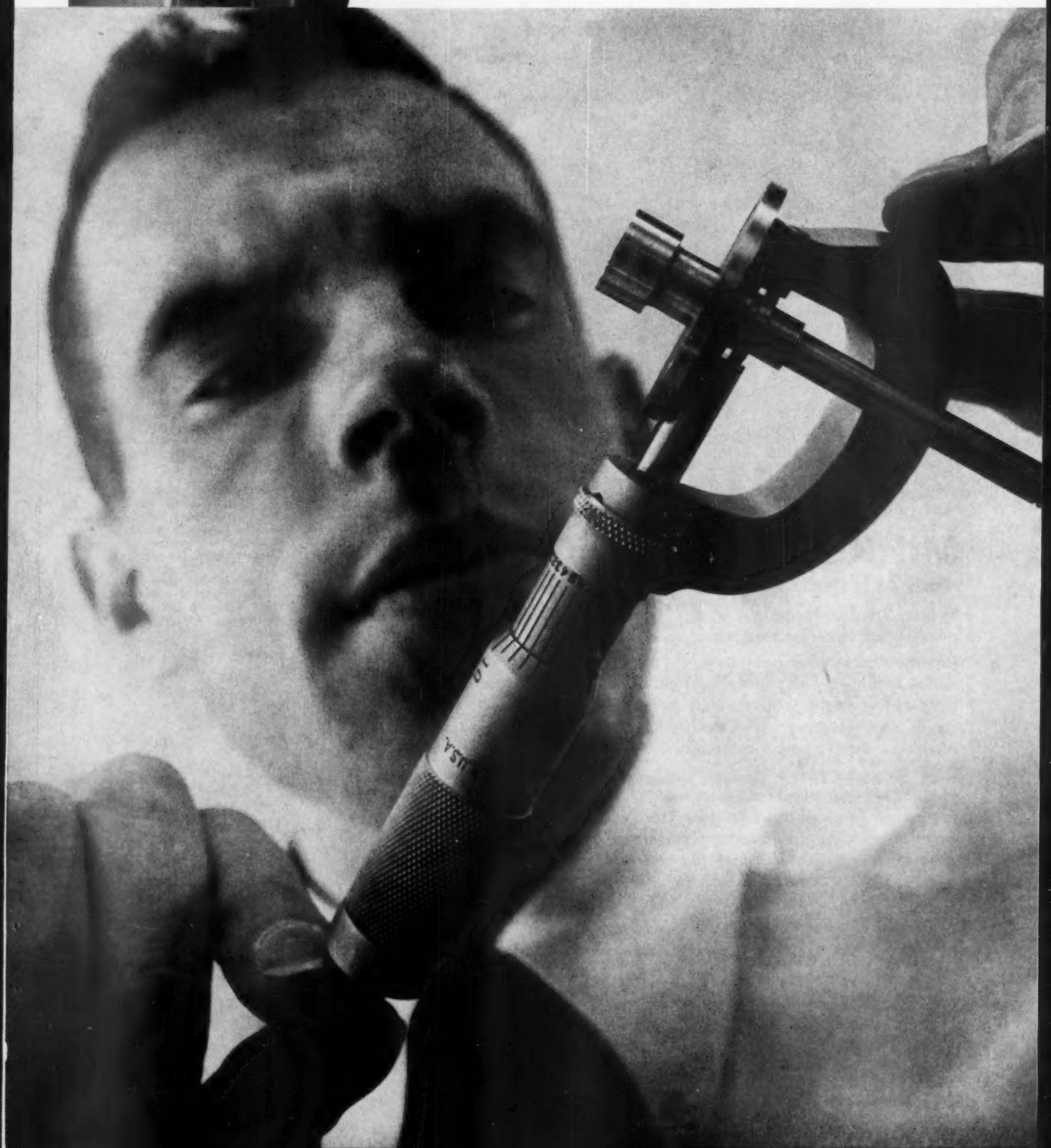
Hughes Aircraft Co, Culver City, Calif, has announced the retirement of **Raymond B Parkhurst,** vice president, manufacturing.

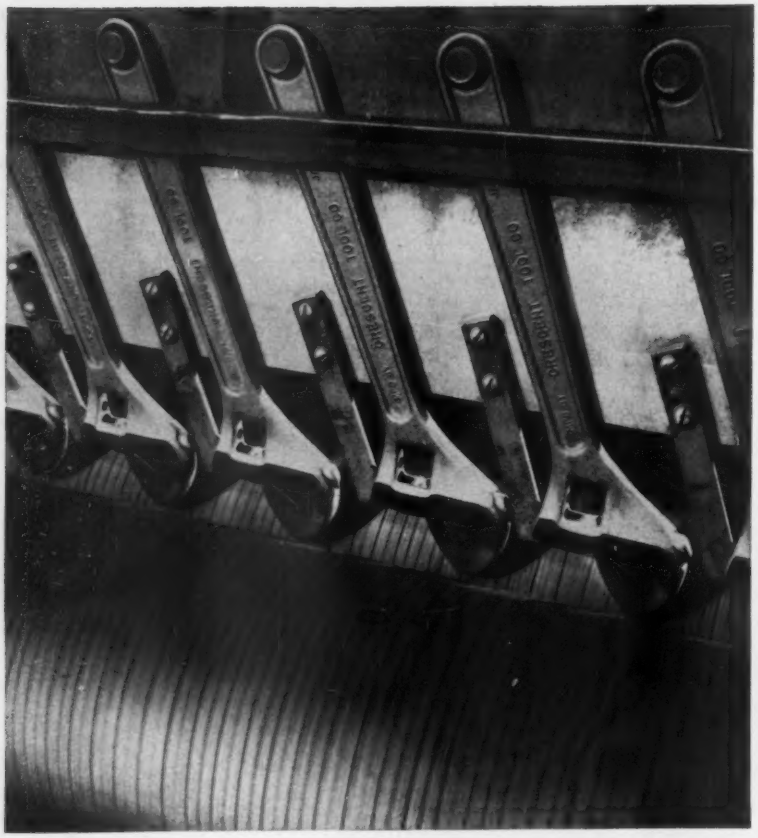
Threadwell Tap & Die Co, Greenfield, Mass, has appointed **Walter Marek** district sales manager with headquarters in Chicago. •

You can do more with DELTA Metal Lathes

Checking closely on tolerances, time and dollars? These accurate, versatile, low-cost machines can pay their way on your jobs. To see a Delta Metal Lathe in action, write for the name of your nearest Delta Lathe Dealer and get a FREE CATALOG: Rockwell Manufacturing Company, Power Tool Division, 618G North Lexington Avenue, Pittsburgh 8, Pennsylvania.

DELTA INDUSTRIAL TOOLS
another fine product by
ROCKWELL





AUTOMATIC BRUSHING SETUP buffs mirror finish on 12" wrench parts for plating. Multiple parts are mounted in special removable fixture. Machine automatically positions and oscillates parts between brushing heads for 25 strokes per cycle. Each head is made up of 65 Osborn Bufcut® treated cord brushes.

MIRROR FINISHING wrenches nine at a time with OSBORN power brushing

This leading tool manufacturer uses Osborn power brushing to buff a mirror finish on forged steel wrenches, pliers and chisels before plating.

Pre-mounted in multiples on removable fixtures, the tool parts are buffed in a special machine which automatically lowers and oscillates the parts between two Osborn Bufcut® brushing heads. The operation is simple, fast, inexpensive. This method has been in continuous use in this plant for nearly 12 years—*still proves to be the best way to do the job today.*

It's a typical example of how Osborn power brushes and brushing methods—through years of exceptional, dependable service—are handling industry's tough metal finishing jobs. If you have a metal finishing problem—deburring, cleaning, polishing, precision blending—an **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, can pinpoint the answer. *Write or call The Osborn Manufacturing Company, Dept. C-113, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

1 HEAVY-DUTY LATHE—*R K LeBlond Machine Tool Co, Madison at Edwards Rd, Cincinnati 8, Ohio.* 16-page bulletin HD-461 pictures and describes the 4025 NK available in both manual and Servo-Shift models. Servo-Shift is designed to make shifting gears almost effortless, with single handwheel selection of cutting speed (fpm and rpm). Options include rpm and fpm selectors at the apron and digital readout at the headstock. Features include a 75-hp motor; 36 spindle speeds from 5.4 to 600 rpm; 48 feed and thread changes. Swing over bed and carriage wings is 40 in., over cross-slide, 25 in.

2 PRECISION BORING MACHINES —*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* 12-page booklet shows in condensed form the complete line of standard units which are used for roughing and semifinishing work as well as for the most precise finishing operations. Includes both horizontal and vertical models, hydraulic and cam-operated. Lists advantages of various models for different sizes and types of work, describes the machines and gives the most important specifications.

3 BORING AND DRILLING MACHINE—*American Tool Works Co, Pearl St at Eggleston Ave, Cincinnati 2, Ohio.* 6-page bulletin 813A describes applications and gives specifications of a 19-in. column traveling openside model. Built to machine massive pieces such as heat exchanger plates and engine bases, unit also handles smaller work set up in one or more areas while parts are being machined in others. Work is handled in an area 104 in. wide and up to 100 ft long. Model has a 30-hp main drive motor; spindle travel is 18 in. Numerically controlled by a GE Mark II control system, machine has pre-selective feeds and speeds with hydraulic power shift.

4 DIE CASTING MACHINE—*Cleveland Automatic Machine Co, 4932 Beech St, Cincinnati 12, Ohio.* 5-page bulletin 561 presents illustrated description of Model 250, a 250-ton high-speed, high-pressure hydraulic unit for producing medium size zinc or aluminum castings. Die plate size (vertical and horizontal) is 29 x 31 in.; max weight of casting that can be produced is 12.5 lb zinc or 5.8 lb aluminum. Machine has locking pressure of 250 tons, strain gage tested, and can be equipped for vacuum die casting.

-Ali-
AM/MM

"Wonder who dropped this stupid idea in the suggestion box!"

NO DOUBT ABOUT IT...

that's why the DIMENSIONAIR is the best air gage you can buy!

No doubt about the Dimensionair's readings

Such sharply defined calibration — the mark of a truly accurate gage — obviously gives you greater resolution, much finer readings than broadly defined graduations and wide hands or air-suspended markers ever can. Each time you gage with the Dimensionair, the needle-thin indicating hand advances smoothly, comes to a positive stop, yet is responsive to the slightest change. Its position in relation to the fine-line graduations is unmistakable. Such decisiveness, coupled with Dimensionair sensitivity, means much greater readability. In fact, tests prove that you get more information from the Dimensionair than from other air gages having *twice* the magnification.

No doubt that the Dimensionair maintains its accuracy

Dimensionair magnification is built-in . . . fixed. No adjustment can change it. That's why the Dimensionair, once set, *stays* set. Air pressure variations cannot affect the accuracy of the Dimensionair. Its balanced air circuit cancels them out. This achieves a stability which cannot be approached by other air gages.

No doubt the Dimensionair is easiest to use

Its fixed calibration and protection against drift guarantees *linear, calibrated* accuracy so you need only *one* master for set-up . . . make only *one* adjustment to set zero. You're ready to gage in less than ten seconds . . . no juggling high and low limits as with other air gages. Dimensionair design gives you wide range operation (up to .006" depending on model selected).*

All these advantages are yours because the Dimensionair, unlike other air gages, is *built* to a specific accuracy and magnification. But don't just take our word for it . . . see for yourself. We shall be glad to demonstrate the Dimensionair to you.

*FIVE MAGNIFICATIONS TO CHOOSE FROM:

1,250:1 (.006" range, each grad. = .0001")
2,500:1 (.003" range, each grad. = .00005")
5,000:1 (.0015" range, each grad. = .00002")
10,000:1 (.0006" range, each grad. = .00001")
20,000:1 (.0003" range, each grad. = .000005")

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G'S UL

In metalworking—men who matter read...

American Machinist / ***Metalworking Manufacturing***

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AM/MM is edited exclusively for men who make things of metal—whether it's a Diesel locomotive or the delicate balance wheel of a watch—men who have a community of interest in the methods, techniques, tools, machines and materials of metalworking.

It's a technical publication for technical men—a work book that shows its readers how to manage metalworking operations and manufacture things from metal more efficiently, more profitably.

When a man reads American Machinist/ Metalworking Manufacturing, we guarantee he will not be left uninformed about any phase of metalworking—a policy that has earned us an all-paid circulation (ABC-audited) of top manufacturing managers, engineers and plant managers in the eight basic SIC classifications that make up metalworking.

Analyze the how-to articles on technology and management techniques, the case histories and working information in any issue, and you, too, will conclude that AM/MM is metalworking's most powerful selling tool.

For up-to-date facts and figures on metalworking, ask your AM/MM district manager for a copy of the 1960 Market Guide for Sales Executives.

the right punch and die at your finger tips...

NEW DI-ACRO PUNCH-PAKS

Punch-Pak No. 1, $139.50
Punch-Pak No. 2, $259.50

- **Off the shelf delivery**
- **Adapters to fit any punch press**

Di-Acro Punch-Paks save you money, cut production delays. No time lost looking for the right size or waiting for special orders. Cost is approximately 10 per cent less than individual punch and die sets—with the rugged, steel store-or-carry chest free. All Di-Acro Punches and Dies are precision made of quality tool steel.

PUNCH-PAK NO. 1 contains 30 sizes of round punches and dies from 3/64 to ½" in increments of 1/64".

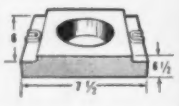
PUNCH-PAK NO. 2 contains round punches and dies from 1/16 to ½" in 1/16" increments, round sizes from ½" to 2" in ⅛" increments, squares in ½", ⅝", ¾" and 1" sizes, one die holder and two die adapters.

Die Adapter A-2 ¾" diameter—1 ¼" bore, Die Adapter B-2 ¾" diameter—2 ⅛" bore.

DIMENSION DATA

All Di-Acro Punches to ½" have ½" diameter shanks, 2 13/32" length.
All Di-Acro Punches from ½" to 2" have 1" diameter shanks, 3⅛" length.
All Di-Acro Dies to ¾" are 1¼" diameter, ⅝" high.
All Di-Acro Dies from ¾" to 1⅜" are 2⅛" diameter, ⅞" high.
All Di-Acro Dies from 1½" to 2" are 2¾" diameter, 15/32" high.

PUNCH AND DIE HOLDERS which adapt Di-Acro Punches and Dies to any punch press are listed in literature on single station punch and die program. Ask for it . . . also for literature on new Adjustable Punch and Die program.



For full information consult Yellow Pages of your phone book under Machinery-Machine Tools for the name of your Di-Acro distributor or write us.

di-acro PRECISION METALWORKING EQUIPMENT

Pronounced die-ack-ro

DI-ACRO CORPORATION
formerly O'Neil-Irwin Mfg. Co.
217 W 8th Avenue, Lake City, Minnesota

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

5 DISK GRINDERS — *Besly-Welles Corp, South Beloit, Ill.* 28-page catalog contains data on latest developments in high-production, precision machines. Models are shown for grinding a wide variety of parts from gage blocks and bathtubs to coil springs and cylinder heads. Materials ground include ferrous and non-ferrous metals, rubber, glass, concrete, carbide. Featured is the DH 4 double horizontal spindle grinder which grinds to accuracy in millionths.

6 PRESS MODERNIZATION—*Fawick Airflex Division, Fawick Corp, 9919 Clinton Rd, Cleveland 11, Ohio.* 8-page bulletin ML-200 presents three different approaches to power press modernization. Compares economic and engineering advantages of conversions incorporating Fawick Airflex clutches and brakes through 1) complete engineering of new press drive systems; 2) combining new power transmission units with reconditioned components; 3) adding new power transmission components to existing drive systems.

7 HORIZONTAL TRUNNION INDEX MACHINE—*Davis & Thompson Co, 4460 N 124th St, Milwaukee 18, Wis.* 4-page illustrated bulletin 180 gives details on new Roto-Matic Type MCI designed for the following operations (singly or in combination): drilling, boring, counterboring, leadscrew tapping, thread rolling and cutting, gun drilling, hollow milling, reaming, and chamfering. Hydraulic feed quill head units can be mounted at any station and can be arranged for single or multiple spindle operations. Work circle of both the 4-station and 6-station machine is 36 in. in diameter.

TOOLS AND ACCESSORIES

8 CARBIDE TOOLS — *Besly-Welles Corp, South Beloit, Ill.* 36-page catalog covers carbide tools with Kennametal material. Featured are carbide tipped tools, blanks, inserts, and holders. Dimensions and prices included.

9 ELECTROMATIC TESTING MACHINES—*Tinius Olsen Testing Machine Co, Easton Rd, Willow Grove, Pa.* 36-page bulletin 63 describes complete line of 2-screw and 4-screw universal machines. Details and specifications are given on standard split cabinet electro-mechanical units in capacities to 1,000,000 lb as well as XY units for specialized research/development testing, and other models, plus a complete line of recorders, related instrumentation and accessories.

10 CHUCKS AND VISES—*AMF Tool Division, American Machine & Foundry Co, 224 Glenwood Ave, Bloomfield, NJ.* 4-page illustrated folder provides information on AMF Wahlstrom drill chucks and Float-Lock vises for both drillpress and bandsaw applications. Pictures operating principles and range of applications of the fully automatic chuck which permits tool changing in seconds without stopping the spindle. Vise is illustrated in use as a lowcost jig, holding work for angle drilling, for assembly work, and other operations.

11 TANTUNG CUTTING TOOLS — *Vascoloy-Ramet Corp, Waukegan, Ill.* 12-page booklet 6102 covers applications for Tantung, a superior cast alloy for cutting tool and wear applications. It is designed for a wide variety of machining jobs at intermediate cutting speeds. Includes information on where and how to use Tantung, how to braze and grind it, and how to use it in combination with carbide or HSS. A section points out the important benefits of using cast-to-form

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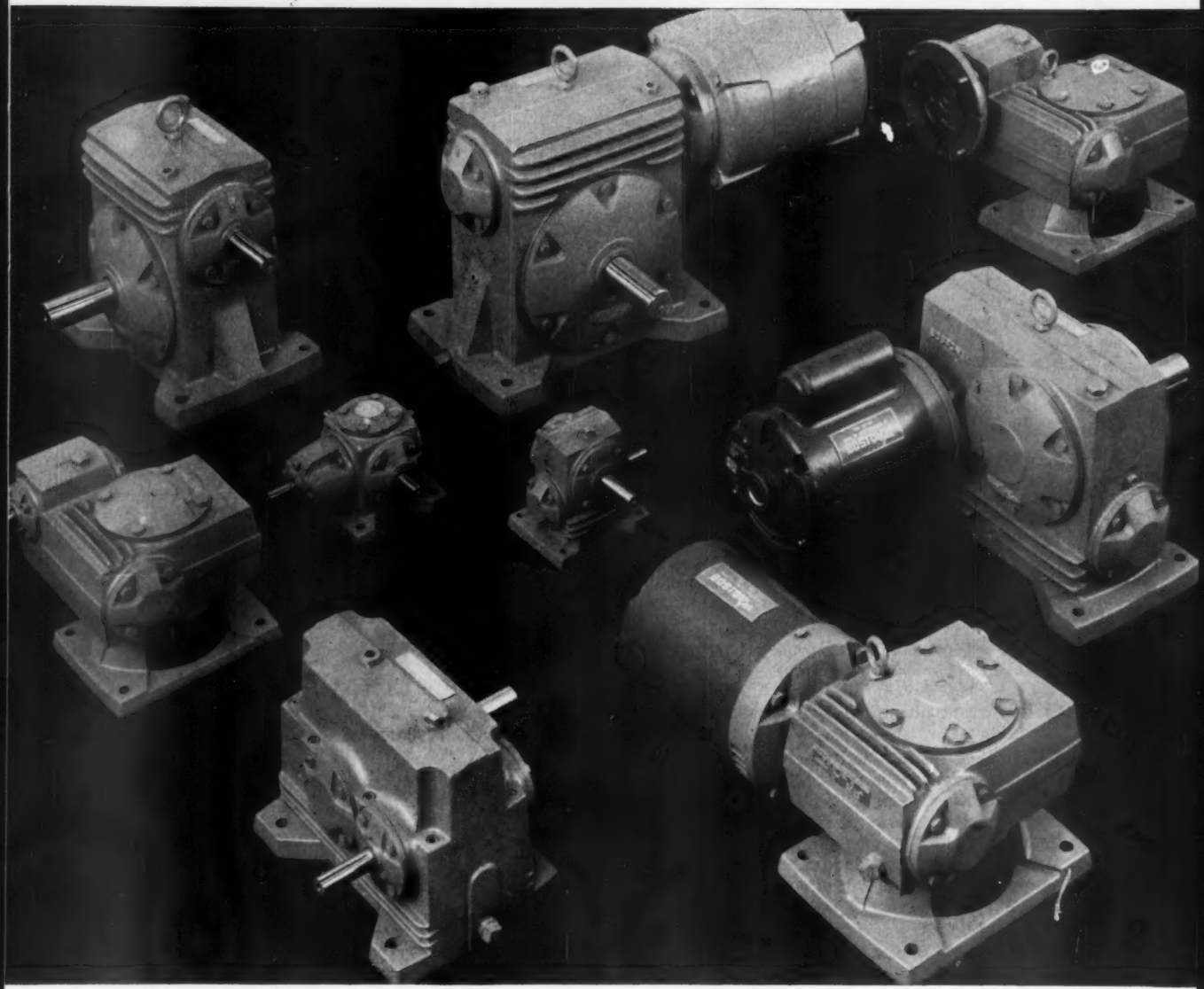

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speed assembly of tiny components

159-TM-B Complete Midget Utility Set
¼-in. square drive — 59 tools in strong metal box

This SNAP-ON ¼-in. square drive set gives you a practical assortment of tools for small, intricate product assembly or maintenance work — electronic components, appliances, communication equipment, etc.

The 59-tool set includes deep hexagon and standard hexagon sockets ranging from ⅛ in. to ½ in.; square sockets; regular tip, Phillips, clutch-type and hex head screwdrivers; plus ratchets and a wide assortment of other handles and adaptors.

The fine quality and precision machining common to all SNAP-ON tools is particularly important in these tiny units. Socket openings, for example, are machined to extremely close tolerances to fit snugly and surely over tiny nuts and bolts without slipping. Driver bits likewise are machined to close tolerances and fit well into screw recesses to avoid gouging of screw heads.

The result is faster work output, far less rejects because of bolt or screw damage. And, because tough SNAP-ON tools last longer, they cost less in the long run.

SETS ASSEMBLED TO ORDER

The above set can be modified to meet your exact needs, or sets of specially selected Midget socket wrenches and other small tools can be developed to fit your exact requirements. Available, too, are Midget industrial sockets in black finish for use on power nut runners. Your SNAP-ON representative will be happy to give you full details. He offers a complete range of hand and bench tools for all industrial needs. Call your nearest branch or write us for new industrial catalog.

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Free Literature

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Tantung tools. Complete surface speed table and tool selector chart shows the general cutting speed range.

12 SIMPLIFIED LUBRICATION — *Texaco Inc, 135 E 42nd St, New York 17, NY.* Technical publication, "Lubrication," June issue, contains tables and charts of recommended lubricants for industrial trucks and for machine tools including heavy-duty grinders, high-speed drilling machines, automatic lathes, milling machines, cylinder grinding machines.

13 INDUSTRY STANDARD — CEMENTED CARBIDE PRODUCTS— *Cemented Carbide Producers Association, 2130 Keith Bldg, Cleveland 15, Ohio.* 39-page publication, "Standard Shapes, Sizes, Grades, and Designations of Cemented Carbide Products" (official government designations is R263-60), covers 44 items which are most popular in industry, such as throw-away carbide inserts, saw tips, chisel blanks, die nibs, masonry drills, and twist drill blanks. Each of the listings for the standard stock items is broken down according to grade of carbide. A uniform system of identification of products is also described.

HEAT TREATING AND WELDING

14 TUBE FURNACES—*Harper Electric Furnace Corp, 110 Pearl St, Buffalo 3, NY.* Bulletin ZT-361 covers modernized line of zoned tube furnaces featuring interchangeable components for increased versatility. Describes standard and optional features of air and controlled atmosphere models available in 24, 30, 36, 42, and 48-in. heated lengths with 3, 4, or 5-in. ID muffles.

15 ARC WELDER — *Lincoln Electric Co, Cleveland 17, Ohio.* 4-page bulletin 4609.1 describes performance features and construction details of a new line of welding machines. Designed to perform equally well in the shop on maintenance or production applications or outdoors on a construction site, the Idealarc R3M 3-phase rectifier type DC arc welder will handle any type of manual arc welding electrode. The high-capacity model can also be equipped for semi-automatic submerged arc welding.

16 INFRARED EQUIPMENT—*Fostoria Corp, Dept 102, 1200 N Main St, Fostoria, Ohio.* Illustrated 4-page brochure describes new techniques using fluid cooling which make possible very compact quartz lamp ovens and furnaces with extremely high heat transfer rates. Additional features claimed for this new equipment are precision control with no contamination during processing. Almost any shape of equipment may be fabricated to meet nearly any requirement for high temperatures (up to 3000 F) or for short cycles.

PLANT SERVICE EQUIPMENT

17 SPRAY CLEANER—*Diversey Corp, 212 W Monroe St, Chicago 6, Ill.* 4-page bulletin provides information on No. 519, a spray cleaner for ferrous and non-ferrous alloys. It is designed for quick soil penetration, complete emulsification and dispersion, and free rinsing and draining. Also described is Diverfos F-72, used to apply a thin, uniform iron phosphate coating following the No. 519 rinse.

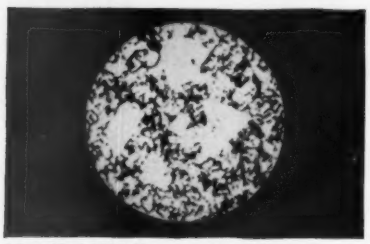
18 AUTOMATIC POLISHING MACHINE — *Yates-American Machine Co, Beloit, Wis.* 4-page bulletin illustrates and describes new Model S-101 designed to produce precision-controlled finishes on sheet metals and plastics. It utilizes a wheel-drum of abrasive impregnated nylon. Drum oscillation is adjustable from 0 to 200 per minute. Feed rates are in-

Linde Coatings & materials News

LINDE COMPANY, DIVISION OF UNION CARBIDE CORPORATION

Abrasives, 99.98% pure alumina, simplify polishing of metals

Once it was a complex art to put precision finishes on metals. Polishing, sharpening, honing involved many abrasives and techniques. Now, with LINDE *alumina* abrasives, metallographic polishing is routine.



Magnified 1500 X—a sample of tungsten carbide with 6% cobalt binder polished by modified procedure for hard materials. (Murakami's etch).

In three grades LINDE 0.3 A (alpha alumina), LINDE 0.05 B (gamma alumina), and LINDE 1.0 C (alpha alumina) —these low-cost, fast-cutting white powders can be used with many materials. LINDE 1.0 C removes material rapidly; LINDE 0.3 A cuts quickly, yet leaves a clear, unsmeared finish; LINDE 0.05 B cuts slower but produces a finer finish. Uniformity of the particle size eliminates levigation in finishing.

Powders can be used dry, or mixed with water or other vehicles to make a thin slurry or heavy paste, or compounded with waxes in convenient stick form. Both are highly resistant to common acids. Check, send the coupon.

Now—high workability for tungsten in crystal form

Ingots of LINDE crystal tungsten can be worked into intricate shapes for electronic, other applications. It can be done at room temperature, using standard machine tools. Metal has no porosity, relatively low impurity, is less brittle than PM tungsten. Crystal tungsten also has unusual ductility, has been drawn into wire as fine as 1 mil for greater yield of finished product from starting ingot. Check, send the coupon for details.

High-grade wear from lower-grade metals —with tungsten carbide coatings

Bearings on the torque meter shaft of a turbo-prop aircraft engine gave only 50 hours operating life, even though the bearings were heat-treated. The short life was caused by severe fretting corrosion. Then the bearing surfaces were given a tungsten carbide coating with LINDE's Flame-Plating process. Service life is now greater than 1500 hours.

A critical tolerance had to be maintained between a ball piston and the piston wall in a hydraulic pump. Carbide inserts mating with steel balls proved unsatisfactory due to differential expansion at operating temperature. Carbide balls added considerable weight. The problem was solved with Flame-Plated steel bushings which had the correct expansion rate and a wear resistance equal to solid carbide—at considerably less weight.

Aluminum toughened

In another situation, aluminum rocker arms were being used in an aircraft heater mechanism to keep weight under overall requirements. But, because of severe sliding abrasion, the relatively soft metal lasted only about 100 hours. When the wearing surface was given a precision coating of tungsten carbide, service life jumped to more than 1000 hours. And the desirable light weight of aluminum was not lost.

These are typical examples of how LINDE's custom-coating service can be used to upgrade many ordinary metal parts by coating their wearing surfaces with tungsten carbide, aluminum oxide, tungsten, molybdenum, other oxides and materials. The thin coatings multiply wear performance many times over —but at the lower costs and with the retention of the other desirable properties associated with the base metals.

If you need technical information on particular problems with wear caused by abrasion, corrosion, erosion—even under conditions of severely high temperature, high load, or absence of lubricant or cooling—LINDE can help you. Check and send the coupon below.

PHYSICAL DATA—FLAME-PLATED COATINGS

COATING DESIGNATION	LW-1	LW-1N	LW-5	LC-1A	LA-2
Approx. Composition by weight	Tungsten Carbide + 6% to 8% Co	Tungsten Carbide + 13% to 16% Co	25% WC + 7% Ni + mixed W-Cr Carbides	85% Cr_3C_2 + 15% Ni-Cr	99% + Al_2O_3 (gamma)
Hardness Vicker's (VPN_{300})	1200 to 1450	1050 to 1150 VPN 70 to 71 R.	1000 to 1200 VPN	850 VPN	1000 to 1200 VPN
Maximum temp. in oxidizing atmosphere	1000°F.	1000°F.	1400°F.	1800°F.	1200°F. to 1800°F.
Coefficient of thermal expansion	4.0 x 10 ⁻⁶/°F. Avg. 70 to 1000°F.	4.7 x 10 ⁻⁶/°F. Avg. 70 to 1000°F.	4.6 x 10 ⁻⁶/°F. Avg. 70 to 1400°F.	6.4 x 10 ⁻⁶/°F. Avg. 70 to 1800°F.	3.9 x 10 ⁻⁶/°F. Avg. 70 to 1832°F.
Modulus of Rupture	67,000 psi	80,000 to 106,000 psi	40,000 psi	75,000 psi	22,000 psi
Modulus of Elasticity	44 x 10⁶ psi	42 to 40 x 10⁶ psi	17 x 10⁶ psi	22 x 10⁶ psi	16 x 10⁶ psi
Porosity	0.5%	0.5 to 1.0%	0.5%	0.5%	1.0%
Specific Gravity	14.2	13.2	10.1	6.54	3.45
Specific Heat	0.048	0.056	0.070	0.127	0.196
Thermal Conductivity	5.3 at 500°F.	5.3 at 500°F.	3.8 at 500°F.	4.3 at 500°F.	0.86 at 500°F.
Main features	Extreme wear resistance	Excellent wear resistance + increased resist. to mechanical and thermal shock.	Excellent wear resist. to higher temps. Improved corrosion resist.	Good wear resist. at high temp. or in corrosive media. Resists flame impingement.	Excellent resist. to wear, chem. attack and high temperature deterioration.

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- ☐ LINDE Alumina Abrasives
- ☐ LINDE Arc Crystal Tungsten

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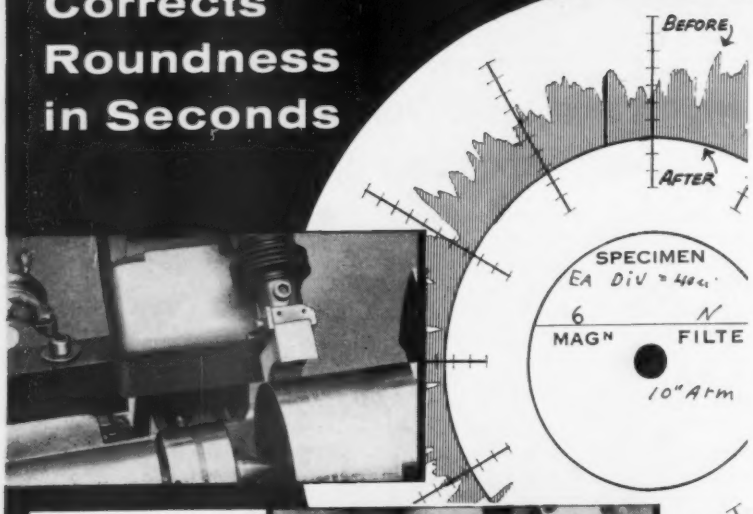
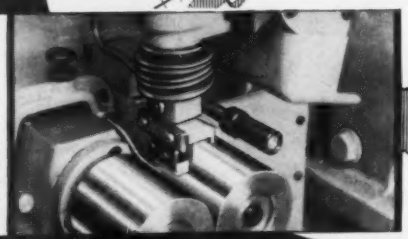
Corrects Roundness in Seconds



This chart demonstrates the remarkable results from Taft-Peirce Microstoning. Outside trace shows an average roundness of .00028" as ground, inside trace shows roundness improved to an average of .000030", after microstoning! These Taft-Peirce Microstoning heads show where the patented Supfina pneumatic oscillation takes place, driving an abrasive stone at frequency of 1800 to 2000 cycles per minute against a rotating workpiece — achieving desired finish and geometric correction in one operation!



Anyone can get roundness correction if he doesn't care about time and cost. But, Taft-Peirce Microstoning produces a *controlled* microinch surface finish, removes cutting tool marks, and dramatically improves roundness — all in one simple operation and in a matter of seconds!

You'll find the results in product quality and performance amazing. Shafts and cylinders run quieter, work smoother, won't wear as fast. And you'll find your whole finishing operation is faster, costs less and is easier to operate. All types of metals, hard plastics, and other non-metallic materials can be microstoned.

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finitely adjustable from 20 to 60 fpm. Two models handle workpiece widths to 51 and 61 in. in thicknesses up to 3 in.

19 ELECTROSTATIC PRECIPITATORS — *American-Standard Industrial Division, Detroit 32, Mich.* 12-page illustrated bulletin 2128 describes new line. Discusses air pollution problem and how it is solved with these units. Includes descriptions of electronic controls and the high voltage rectifier, available in four types. Application and installation photos included.

20 NOISE CONTROL—*Owens-Corning Fiberglas Corp, National Bank Bldg, Toledo 1, Ohio.* 14-page technical brochure, "Appliance and Equipment Quieting Materials," outlines effective approaches to solving acoustical problems in appliances and equipment. The booklet can guide engineers toward the source of sound trouble and suggest practical and economical solutions using existing Fiberglas products. It is illustrated with performance tables, nomographs, drawings, and photographs.

21 CRANE SPECIFICATIONS—*Conco Engineering Works Inc, Mendota, Ill.* Crane Specification Tablet contains five duplicate sets of crane specification data and forms designed to aid in establishing specs for a given application. Gives data on classes of service, speed classifications for bridge, trolley and hoist, and information on girders, trucks, electrical systems, brakes, cabs, and other components and design considerations involved in an overhead electric crane specification. Data applies to industrial cranes of any manufacture.

PARTS AND MATERIALS

22 ALUMINUM CASTING ALLOY—*William F Jobbins Inc, Aurora, Ill.* 8-page bulletin describes characteristics of Precedent 71, a high strength, shock resistant material similar in characteristics to Almag 35, developed for use where higher yield strength and lower elongation are required. Alloy comes in two grades, Precedent 71A and 71B to accommodate different sets of conditions. Both can be completely stress relieved at 700 F, become completely stress free, and develop full mechanical properties thereafter, making them ideal for use in parts subject to severe fatigue loading.

23 VALVES—*Hydromatics Inc, 5 Lawrence St, Bloomfield, N.J.* 16-page catalog covers Flo-Ball line. Included are cutaway drawings, pressure/temperature curves, and dimension tables and drawings.

24 FLEXIBLE CUSHION COUPLINGS —*Dodge Manufacturing Corp, Mishawaka, Ind.* 24-page bulletin 901B illustrates and describes expanded line of Para-flex couplings that absorb vibrations and compensate for all combinations of shaft misalignment and end float. Included are a new PX280 coupling with more than twice the torque capacity of the next smaller size, and a new PX90 intermediate size. Installation pictures are included with descriptions of standard, high speed, and flywheel types of Para-flex plus data on horsepower ratings, dimensions, prices, and weights.

25 MECHANICAL POWER TRANSMISSION EQUIPMENT — *T B Wood's Sons Co, Chambersburg, Pa.* 8-page bulletin 23103 is a condensed catalog of many products including V-belt, Ultra-V and FHP drives, timing-belt drives, flat belt pulleys, variable-speed drives, motor bases, flexible couplings, bushings, bearings, and pillow blocks. ●

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. . . a fast, precision screw machine!

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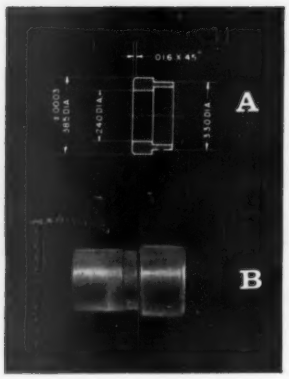

A Brass Bar Stock. Collars. Limit on diameters: ±.0003". Finish: Better than 30 rms. Part previously roughed on one machine and finished on another.

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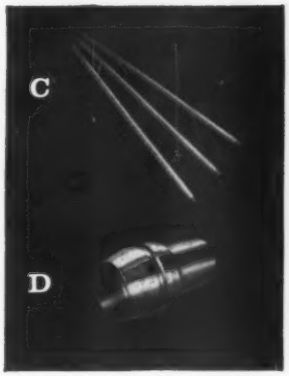

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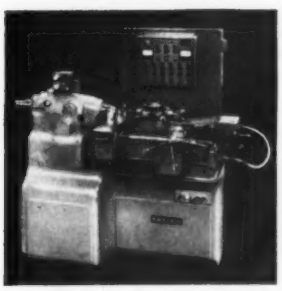

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improved filter, rinse & dryer

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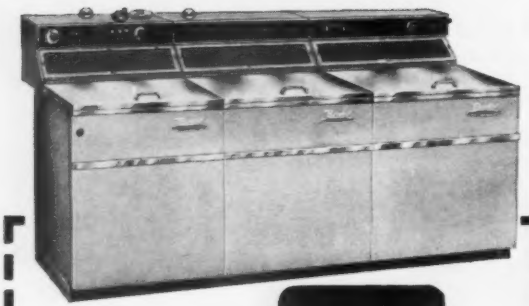

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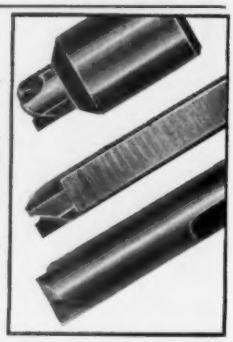
Write today for information on W & S Hollow Mills or for recommendations on any small precision cutting tool problem.



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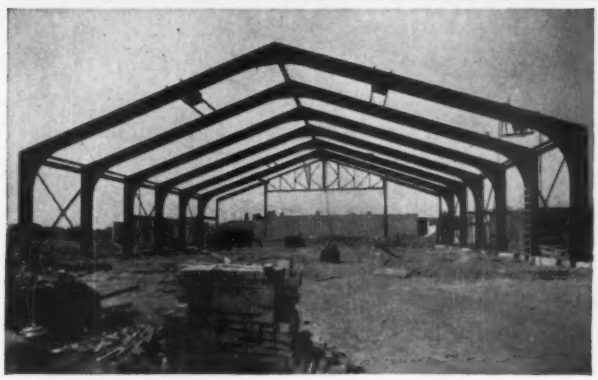
All shearing at the Art Iron & Wire Works, Inc., a 200-employee plant in Toledo, Ohio, is done on a Steelweld Pivoted-Blade Shear rated for ¾" x 12'-0" mild steel. This is the only shear in the plant.

Art Iron manufactures ornamental iron and structural steel items to order and also has a large steel warehousing operation. An inventory of over 10,000 tons of steel of every kind, size and shape is maintained to serve any need. This work keeps the Steelweld busy cutting a great variety of steel items varying in thickness from 18 gauge to ¾ inch.

The Steelweld feature most valued by Art Iron is the knife-clearance adjustment. They know that to obtain the best cut with the least burr and distortion, it is essential to have the clearance set to suit the plate thickness. Because this adjustment is so easy and fast to make, their shear operators make it automatically as a part of the regular shearing routine.

Knife life is very satisfactory. This is attributed in large part to the shear operators consistently using the proper knife clearance. Despite the large tonnage of steel cut, the knives usually require regrinding only once in a period of four months or longer.

The Art Iron, Ft. Wayne, Indiana, plant also has a Steelweld Shear. Its purchase several years ago was influenced by the success with the machine in Toledo.



Prefabricated industrial buildings are among the many items made by Art Iron. These require a large number of plates for footings, gussets, splices, etc., all of which are sheared on the Steelweld.

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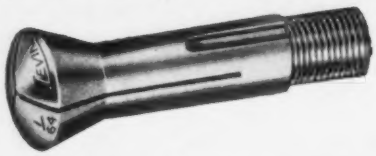

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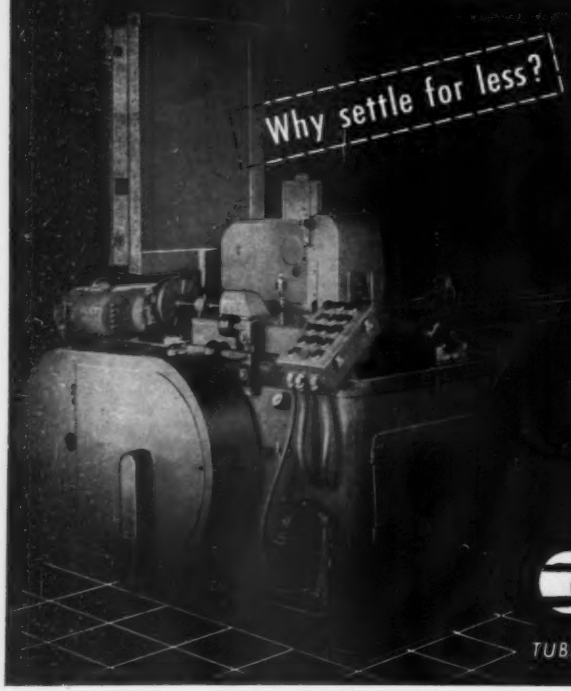

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ASD-238

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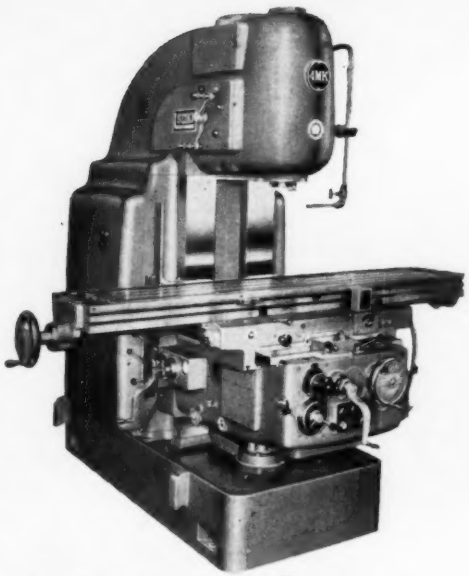
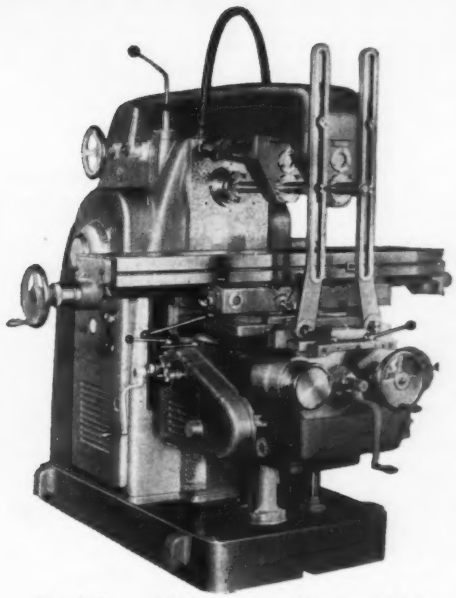


Model 4MK Heavy Duty Milling Machines (Vertical Type)



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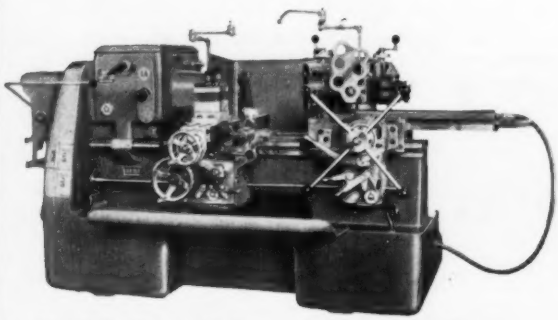
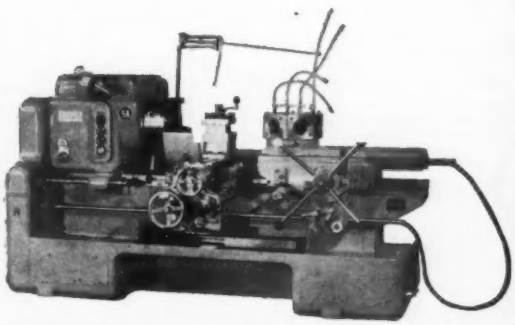


Model 4A Universal Turret Lathes



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3. Automatics
7. Boring Mills
8. Broaching Machines
17. Drilling & Reaming Machines
20. Fabricating Equipment
26. Grinding Machines
30. Keyseaters
31. Lathes
33. Machine Tools
37. Milling Machines
42. Planers
45. Press Brakes
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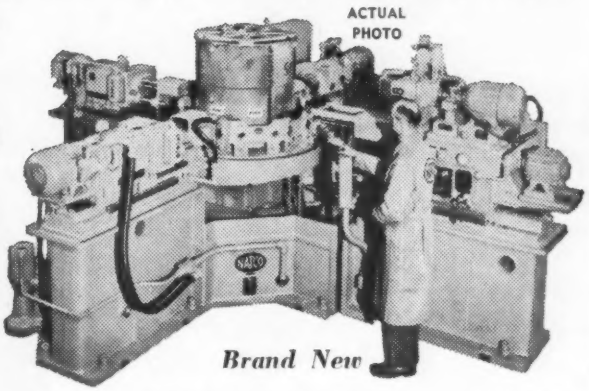

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BRAKE PRESS: 5/16" x 12' Dreis & Krump, #612D, 14½" bed, 12½" bet. hgs., 250 ton, 1945.
DRILLS, RADIAL: 4' x 12" Fosdick Sensitive, #4 M.T., 1952.
DRILLS, RADIAL: 6' x 15" Carlton, 48 spdl. sp. to 1500 R.P.M., 15 H.P., 1941
DRILLS, RADIAL: 6' x 19" Fosdick Economax, #6 M.T., M.O.A., Ser. 6792.
DRILLS, RADIAL: 8' x 19" Fosdick Economax, #6 M.T., M.O.A., Ser. 6859.
GRINDERS, SURFACE: 9" x 40" Thompson Type B, Hyd., new 1943, rebuilt 1953.
IRON WORKERS: #2½ Buffalo Universal, 1940.
IRON WORKERS: #20 Pels.
PLANERS: 36" Cincinnati Openside, mechanical type, 10 H.P., 1941.
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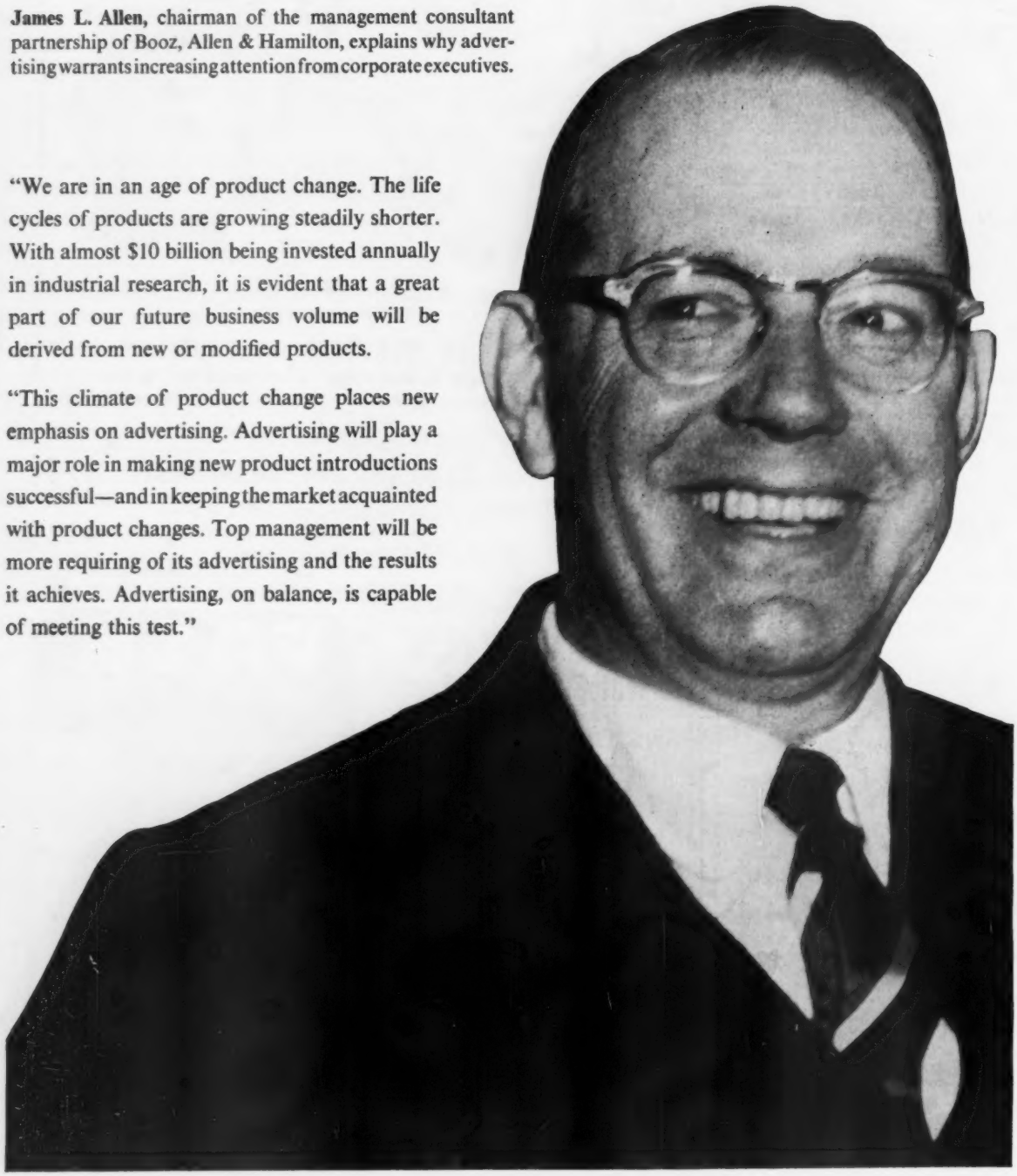

"We are in an age of product change. The life cycles of products are growing steadily shorter. With almost $10 billion being invested annually in industrial research, it is evident that a great part of our future business volume will be derived from new or modified products.

"This climate of product change places new emphasis on advertising. Advertising will play a major role in making new product introductions successful—and in keeping the market acquainted with product changes. Top management will be more requiring of its advertising and the results it achieves. Advertising, on balance, is capable of meeting this test."

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GOLD STAR SRH

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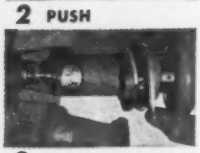

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4 GRIND

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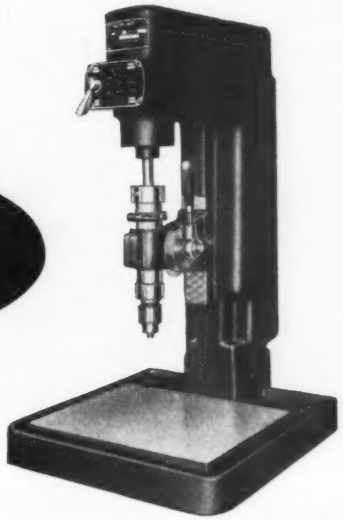

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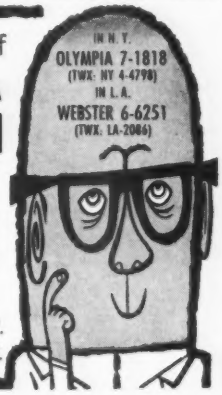

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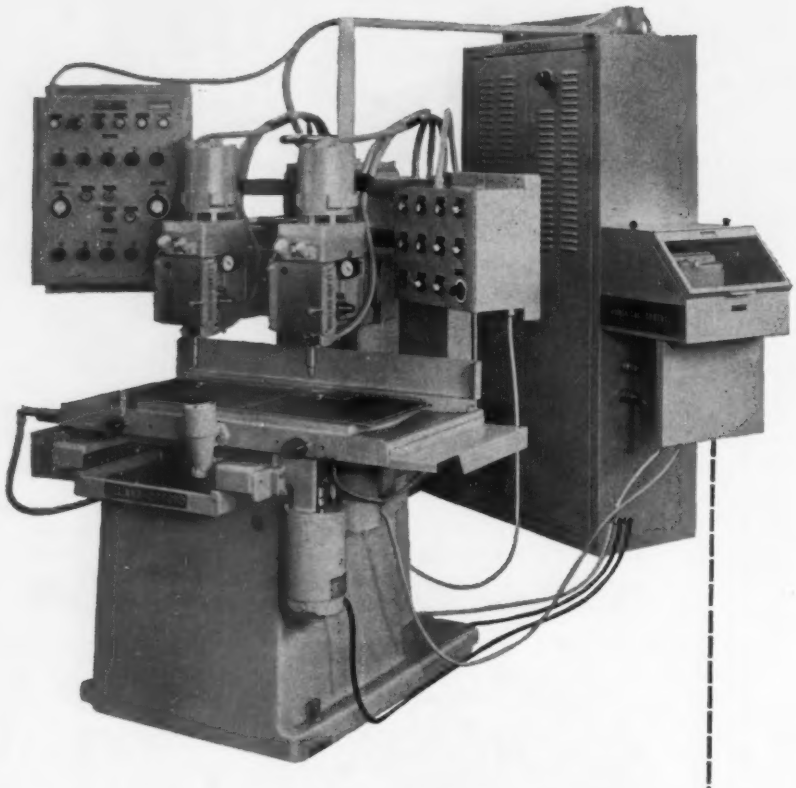

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